Heating Piping & Air Conditioning

JULY
1959

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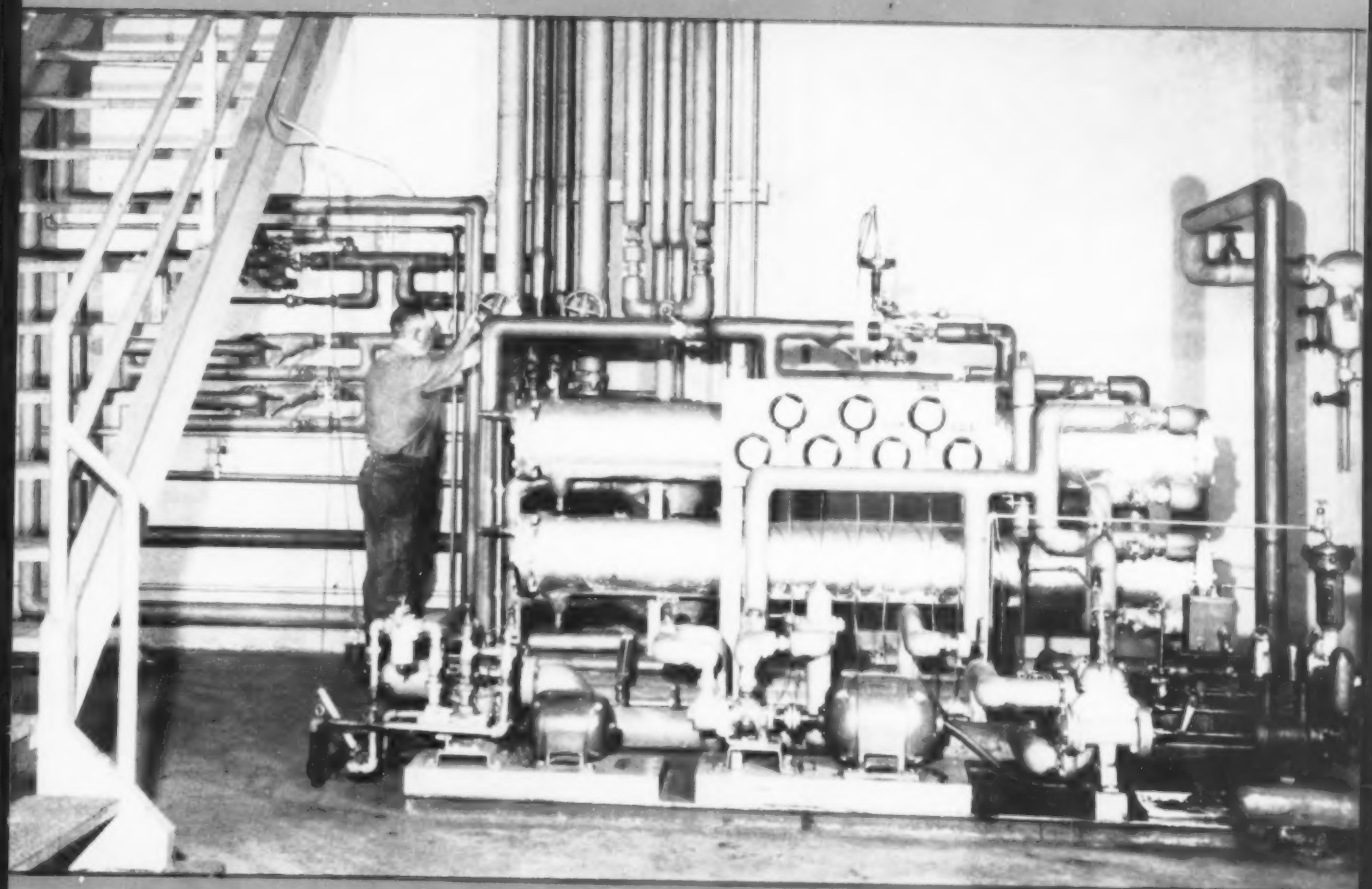

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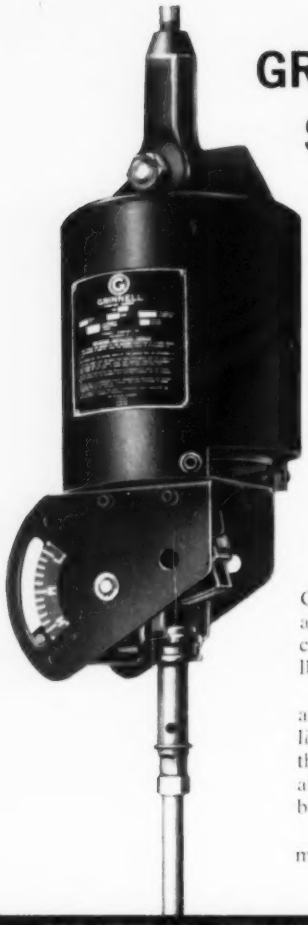

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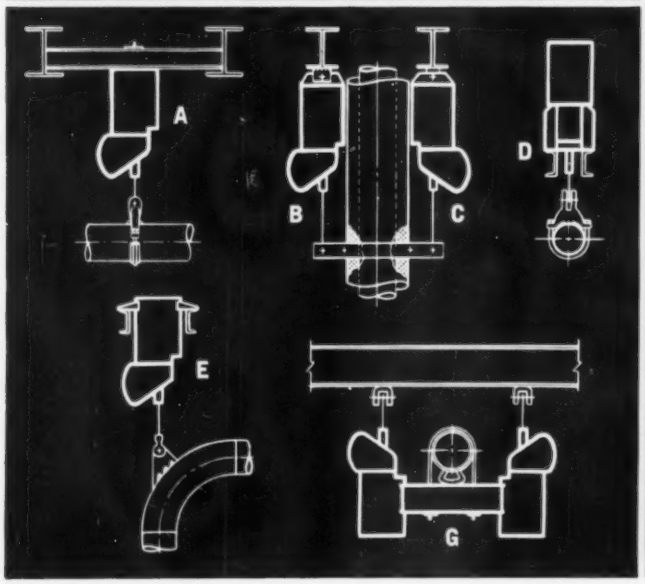

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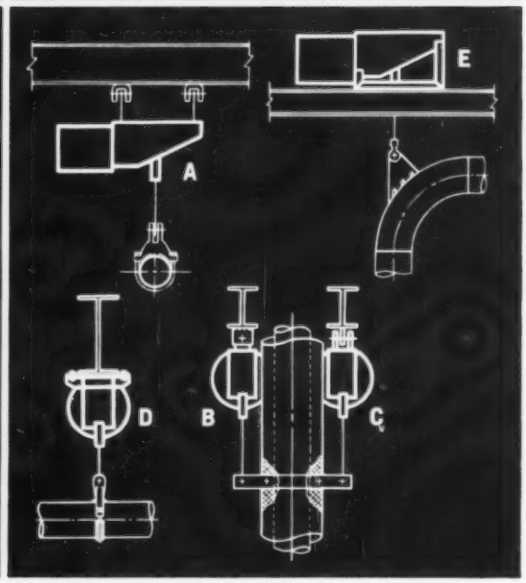

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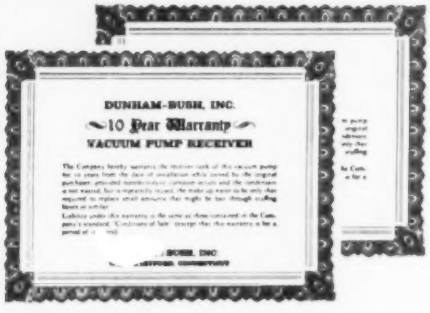
Recognizing a general industry trend to put price in a paramount position and inherent dangers of quality control in such a concept, Dunham-Bush has taken this step.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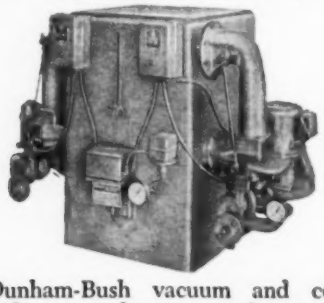

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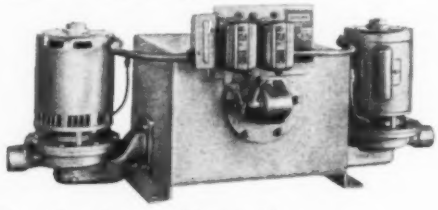

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Product Data Available

File 1401 B gives complete Dunham-Bush vacuum pump specifications and data. Form 1403 details the condensate pumps. Sample Warranty available for inspection. Request direct from manufacturer.

Dunham-Bush, Inc.

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WEST HARTFORD 10, CONNECTICUT

Heating Piping & Air Conditioning

Vol. 31, No. 7

July 1959

(With which is merged the Aerologist)

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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $5.00 per year; Canada, $5.00 per year; Cuba, Mexico, Central America, South America, Spain, $6.00 per year; other, $7.00. Current copies, 75c each; back copies, $1.00 each. January 1959 issue $2.00 per copy. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms. ©1959 by the Keeney Publishing Co. SECOND-CLASS POSTAGE PAID AT CHICAGO AND MENDOTA, ILL.

SUBSCRIBERS—*Change of Address*: Publisher needs five weeks' advance notice, mail address from current issue envelope, and new address with city postal zone number. Mail to . . . Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., U. S. A.
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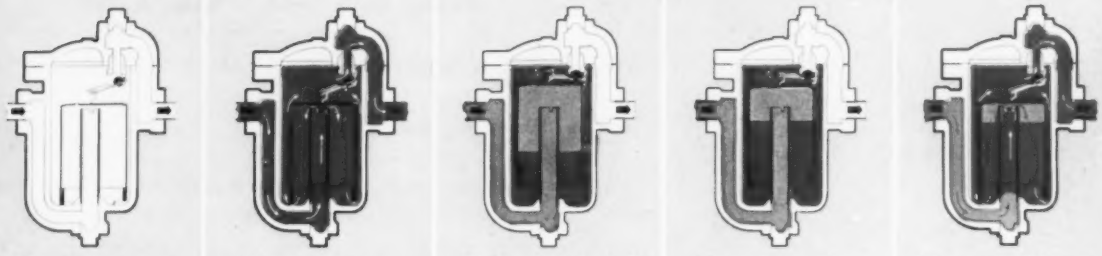
This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam



When trap is first installed, the inverted bucket is down and the valve is wide open.

When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —

Steam (light color) reaching the trap floats the inverted bucket and closes the valve.

When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.

When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

Key: condensate steam steam bubbles air bubbles

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are designed and made to give you these big benefits:

Armstrong Traps, the first inverted bucket steam traps, now represent the most advanced development of this time-proven principle. They provide all the advantages necessary for efficient, economical condensate drainage from virtually all types of steam using equipment.

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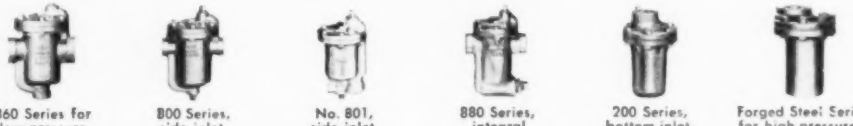
4. *Operates on any back pressure* – Failure of one trap in system will not cause others to open because high back pressure does not affect an Armstrong trap other than to reduce capacity. As long as there is a pressure differential across the orifice the trap will close on steam and open for condensate.
5. *Unaffected by ordinary dirt* – Swirling action of condensate keeps dirt in suspension until discharged with condensate, prevents it from lodging in valve.
6. *Completely dependable* – Proved design plus the use of all stainless steel working parts assure continuity of service and length of service unmatched by any other trap.
7. *Big capacity in a small, economical package* – Armstrong design gives you the highest practical capacity for any given pressure. And remember, Armstrong capacity ratings are based on *hot* condensate at the *working pressure differential* stated, not on theoretical orifice capacities.

Further information on these advantages plus much additional information is given in the 48 page Armstrong Steam Trap Book. Ask your local Armstrong Representative or write direct.



860 Series for low pressure heating service. 800 Series, side inlet, side outlet. No. 801, side inlet, bottom outlet. 880 Series, integral strainer. 200 Series, bottom inlet, top outlet. Forged Steel Series for high pressures, high temperatures.

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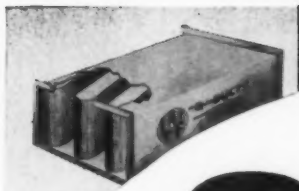

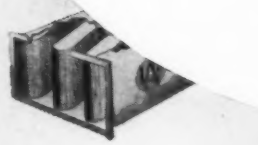

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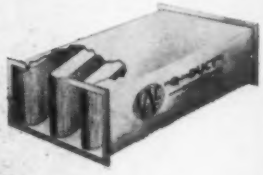

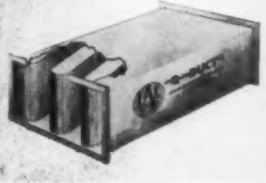

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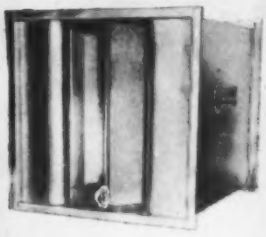

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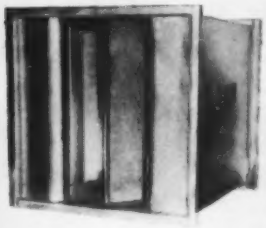

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LETTER FROM THE EDITOR

July 1959

Dear Reader:

Engineering ingenuity in the application of a variety of heating systems to suit many needs is illustrated in the article on page 99 by Robert S. Glasier. He explains how the Nazareth Children's Boarding School in Boston is heated with warm air, hot water floor panels, and direct steam radiation, all served by a central steam boiler plant. The cost for these heating systems and an assortment of ventilation systems was but 14.5 percent of the total construction cost for the project. High pressure steam was necessary for these facilities, and this determined the type of heat generating plant. Since steam was required at two different pressures, it was decided to use a central boiler plant in order to localize all combustion equipment, to save space, and to shorten piping runs. Floor panel radiant heating was selected for the main parts of the institution since these consist of children's units where warm floors are a necessity. It was decided to use air as the heating medium in the chapel in order to blend the system in with the architectural features.

Plans have now been finalized for construction of an outdoor central heating and cooling plant, which will cost about $1.5 million, at the New Orleans campus of Louisiana State University. This is believed to be the first time a complete university campus will be provided with chilled water and high temperature hot water from an outdoor plant. These plans and details are discussed by Warren G. Moses on page 104. All equipment will be weatherproofed, and the facility will be controlled from a two-story tower, the only enclosed structure in the installation.

Refrigerant piping systems have certain operating characteristics that demand special consideration, explains W. C. Smith on page 106. In selecting piping materials, it should be realized that refrigerants are often toxic and sometimes explosive. Also affecting the piping material selection is the fact that refrigerants undergo various physical changes in completion of their cycles and that they flow at lower than normal temperatures. It is of course imperative that all applicable codes be considered in the design of these piping systems.

Missile manufacturing depends on air conditioning, and Joseph N. Sabatini (page 109) explains how both packaged units and built-up systems provide the varying tolerances of air cleanliness, temperature, and humidity for this service at one plant. Packaged units, modified as necessary, are used wherever their advantages are not outweighed by those of the built-up type of installation. Areas with widely fluctuating loads, humidity control problems, and air distribution restrictions are served by systems using radial type compressors and water cooled condensers combined with fan-coil units. Four hundred and thirty tons of air conditioning capacity is installed in 26 different areas. Nearly all of these areas are enclosed with 10 ft high insulated partitions and ceilings.

Central or zone control of steam heating systems, long a common practice, is being questioned, according to Lewis Smith in his article on page 112. He considers the questions one by one and shows why central or zone control is desirable as the basic system. Of course, particular job conditions should be considered in adapting these systems to achieve the desired degree of control.

Who's responsible for what in the design and installation of air conditioning systems in big buildings? This was answered by Frank A. Player, mechanical (heating, piping, and air conditioning) contractor, Robert A. Urban, consulting engineer, and Vincent G. Kling, architect, at the air conditioning panel session held in Washington at the time of the convention of the Mechanical Contractors Association of America, reported on page 116. All agreed that present lines of responsibility sometimes leave something to be desired. They also agreed that the importance of the general contractor as supervisor for the entire job tends to decrease with the increasing complexity of the mechanical systems. Mr. Player said the consulting engineers' drawings are diagrammatic and that larger scale shop drawings should be made by the mechanical contractor so that each piece of equipment can be fit into the space allocated by the consulting engineer. Mr. Player also stressed the need for the mechanical contractor to balance each air conditioning installation and check the controls for proper operation. He suggested that the term "or equal" be eliminated in the specification and that four, five, or six named products be given in the specification, from which the mechanical contractor may choose. Mr. Urban stressed the need for close coordination between the architect and the consulting engineer so that sufficient space for mechanical equipment is provided. Mr. Kling emphasized the need for selecting a good team of contractors who have worked together on previous jobs.

A new method for design of pipeline expansion loops is given by Louis E. Partch on page 123. Welding fittings and dependable welding practices have led to the design of expansion loops to be more rectangular in shape. Often these loops are placed underground where expansion space is limited. This article presents formulas and charts for determining the dimensions of these pipeline expansion loops and for checking existing loops to determine the maximum stresses encountered.

The industrial ventilation article this month tells how to design freeze protection for hot water heated industrial supply air systems (page 130). The author is S. I. Rottmayer. He explains that a small amount of hot water, passed through a well-designed and properly controlled piping system, is a good way to minimize damage to industrial ventilation systems handling freezing outdoor air. He suggests the use of a three-way valve which responds to temperature so that just enough hot water is admitted to satisfy the thermostat.

The "HPAC Engineering Data File" this month, on pages 141 to 156, is on the subject of noise in heating, piping, and air conditioning systems. The design of these systems is not complete unless consideration is given to the noise level that will be produced in the occupied space. Neglecting noise levels can lead to the rejection of a system that is otherwise satisfactory. To control the noise heard by the occupant, the path by which the unwanted sound is transmitted must be modified or the source must be quieted. The latter is largely the responsibility of the manufacturer, but the engineer and contractor must know the sources of equipment noise so that they are in a position to select quiet equipment. This report considers the sources of noise in these systems and some of the factors to consider in the design. The basis for these designs must be upon noise generation and attenuation in eight frequency ranges or octave bands. A procedure for doing this is given.

The question, "Will Anti-Freeze Harm Boilers, Greatly Affect Heat Transfer?" is answered by several readers on pages 88 and 90. More steam pipe sizing data is given on pages 135 and 136 in the HPAC Data Sheet. The first tables in this series were presented in the June Data Sheet, and they will be continued next month. "Open for Discussion" is on pages 83 through 86, and the You'll Want to Know news items are on pages 37 to 44.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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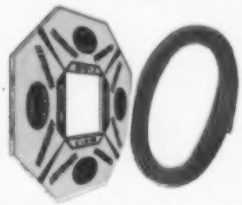

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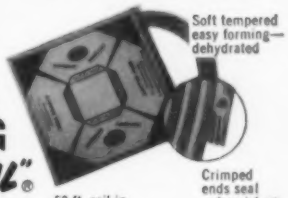

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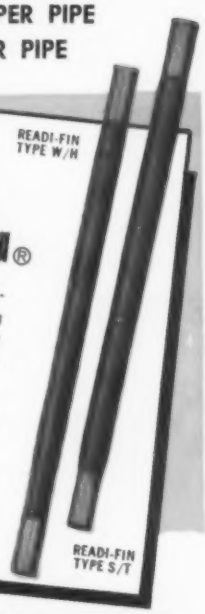

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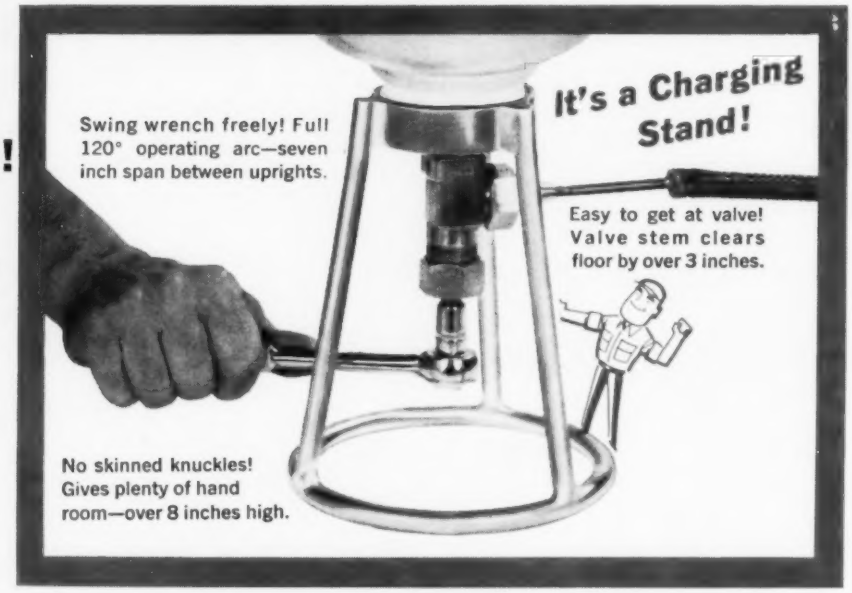
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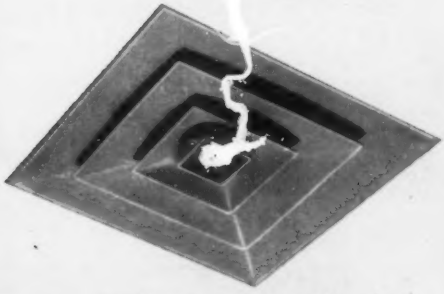

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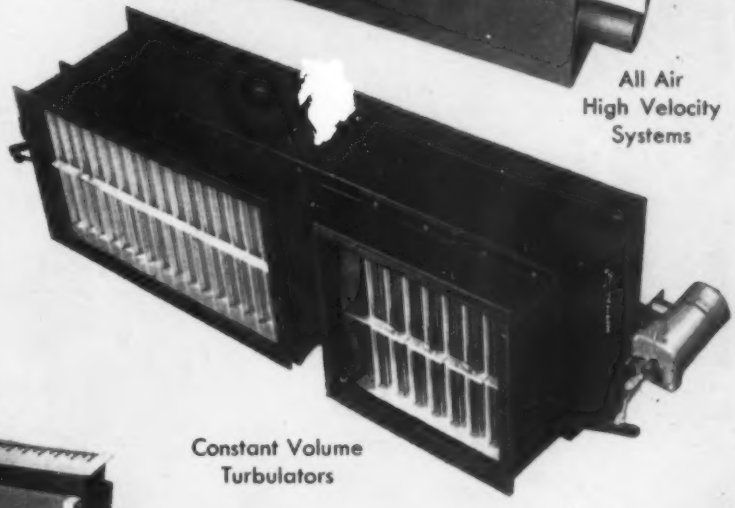

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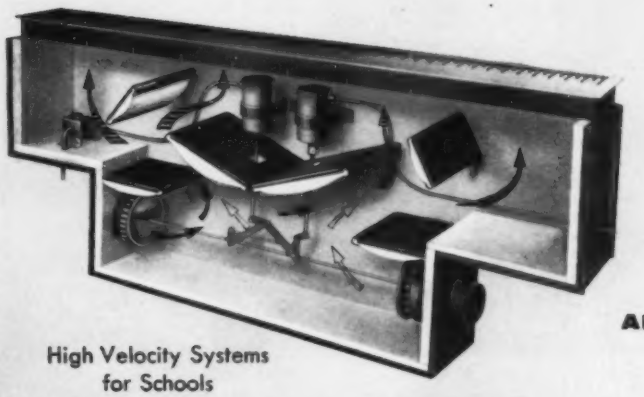

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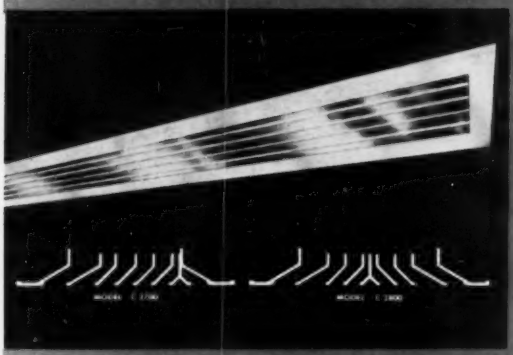

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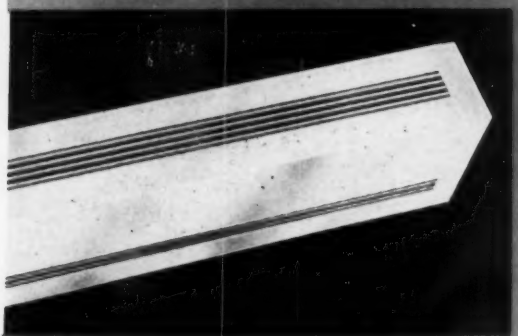

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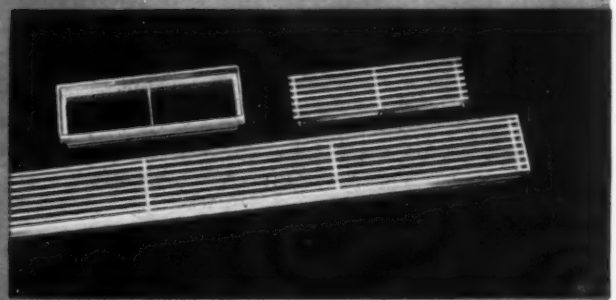

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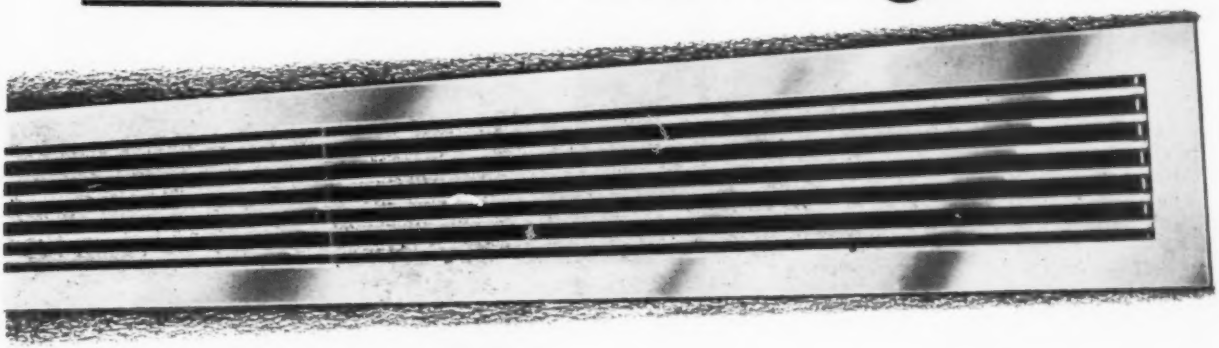

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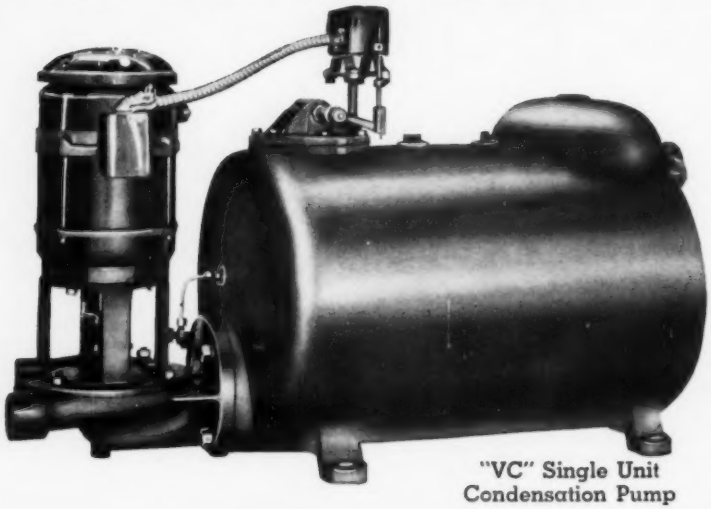

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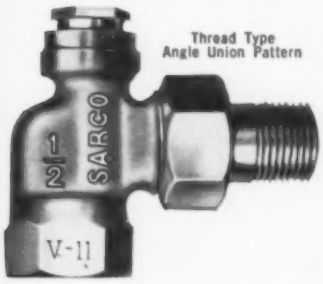

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Angle Union Pattern

Thread Type
Straightway Union
Pattern

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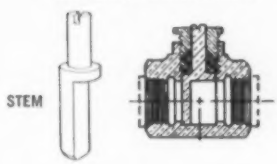

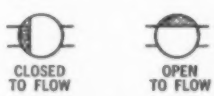

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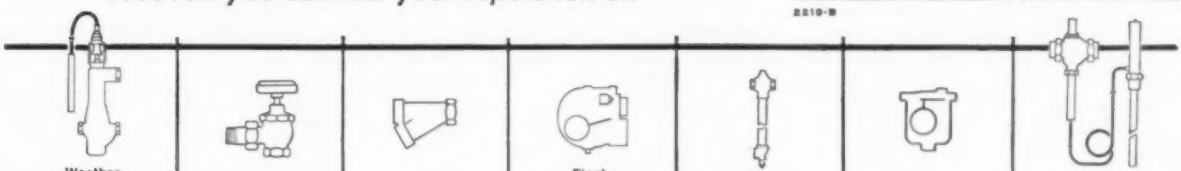

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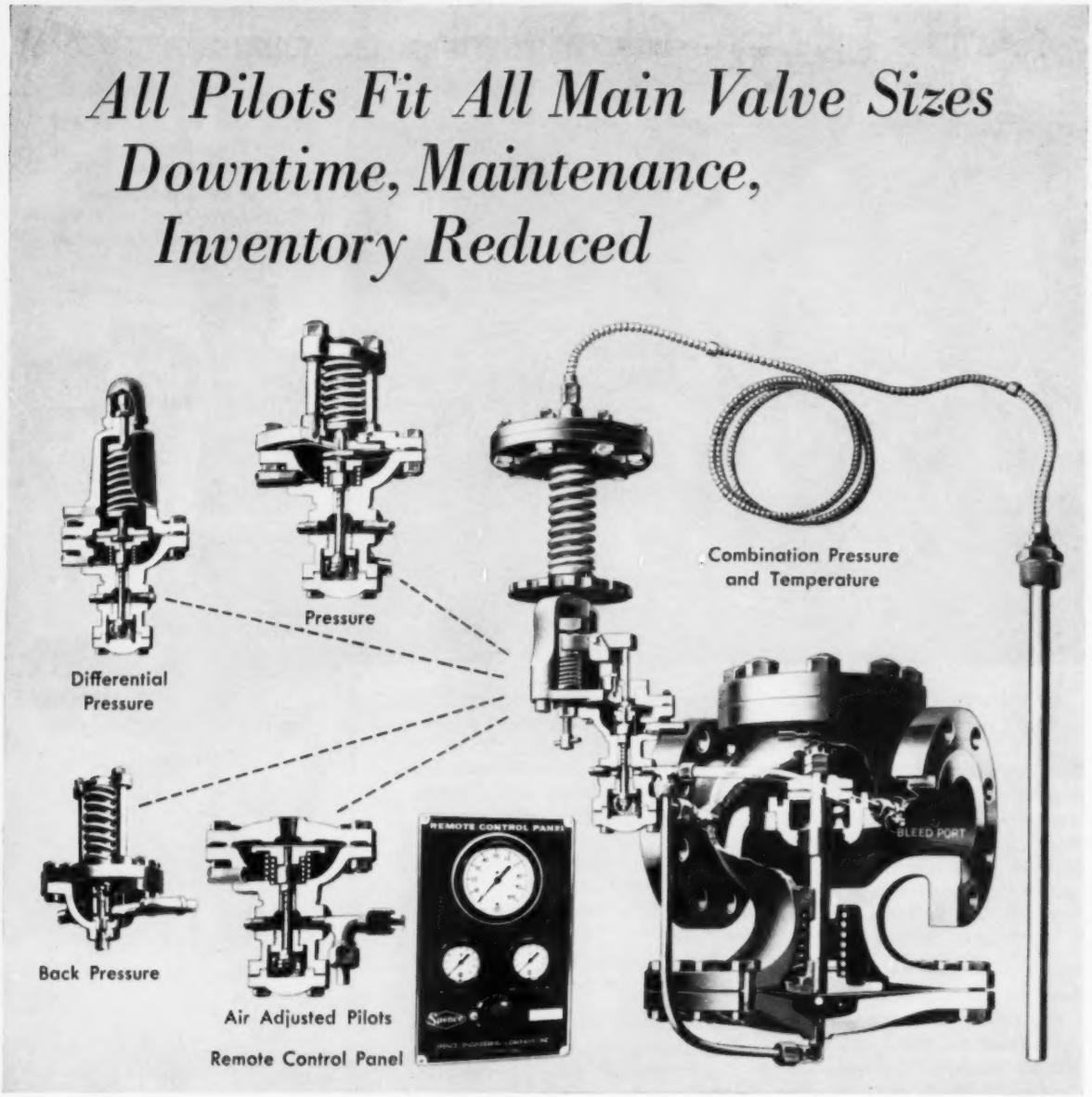

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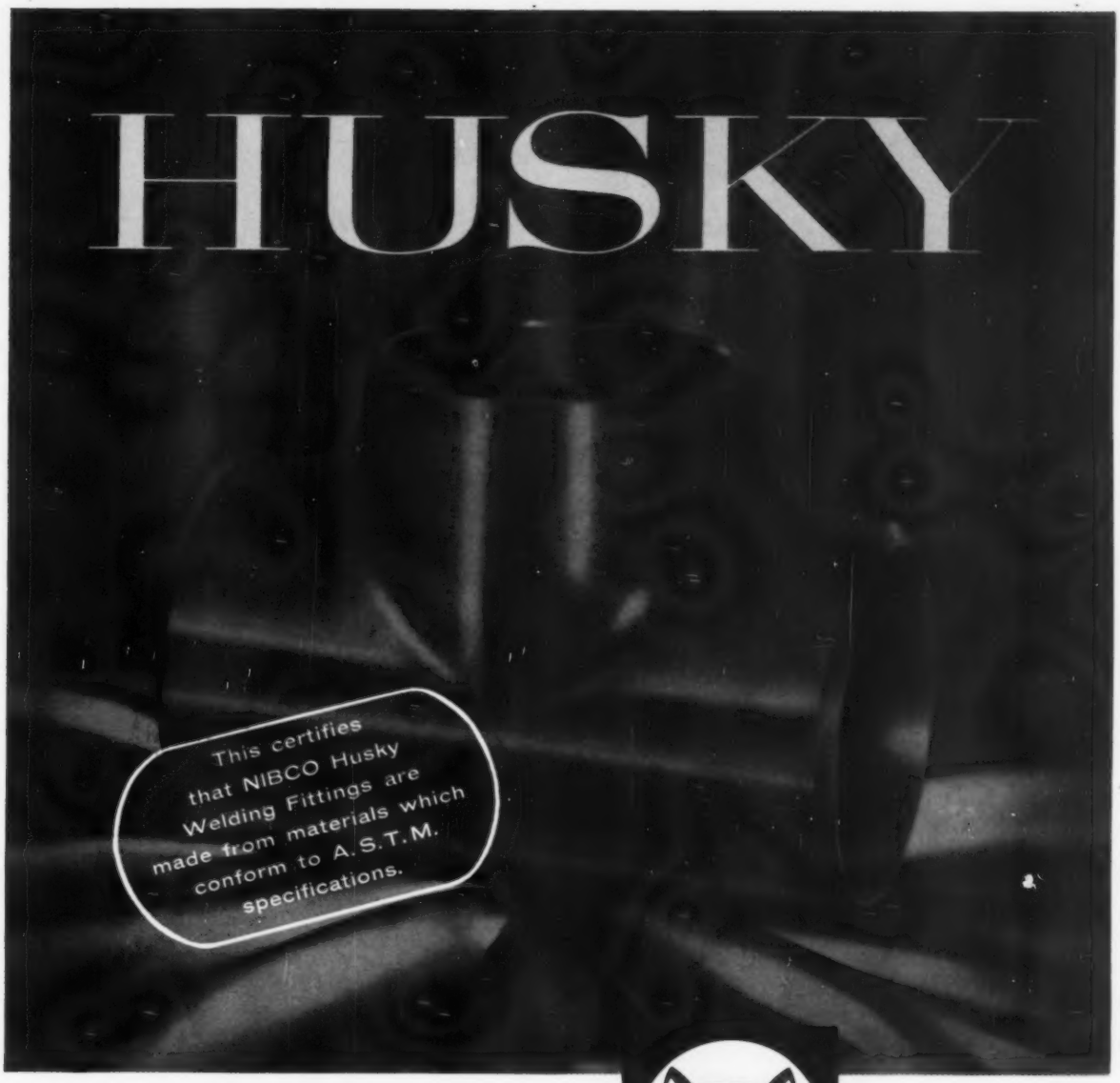

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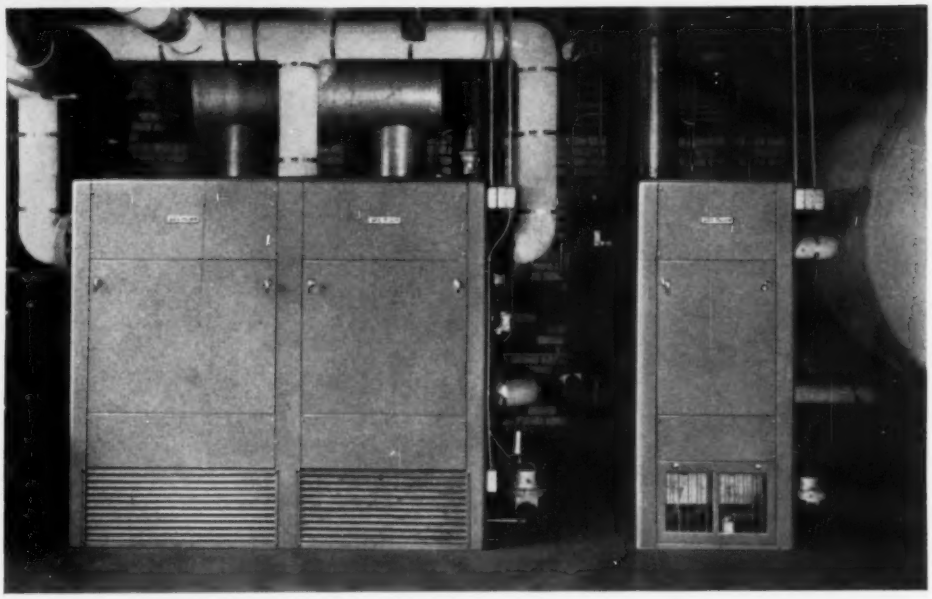

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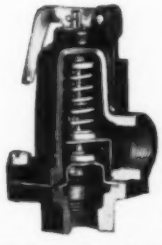
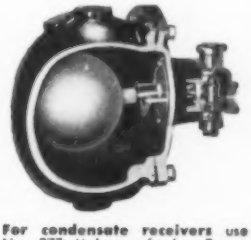


For hot water heating boilers your best bet is the 230 or 240 Series pressure relief valves. They meet ASME Code, are Btu-rated by National Board. Wide range of sizes to answer all needs. McDonnell also offers water feeders and cut-offs for use on hot water heating boilers. For domestic water systems the 230 and 240 Series are available with higher opening pressures.

For larger steam heating boilers—above 5000 sq. ft.; maximum steam pressure, 35 lbs. — use the No. 51-2 feeder and cut-off combination. Other McDonnell combinations available for larger and smaller boilers.

For steam boilers up to 150 lbs. pressure install the No. 150 (shown) pump control, low water fuel cut-off and low water alarm switch. Most widely used control of its kind. No. 157 is same but has integral water column for easy installation.



For condensate receivers use No. 271 Make-up feeder. Teams up with No. 150; maintains minimum supply in receiver to meet any boiler demand for water. Has stainless steel valve and seat for drip-tight closure.

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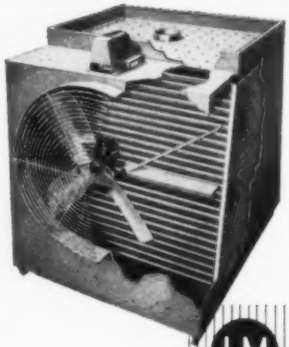

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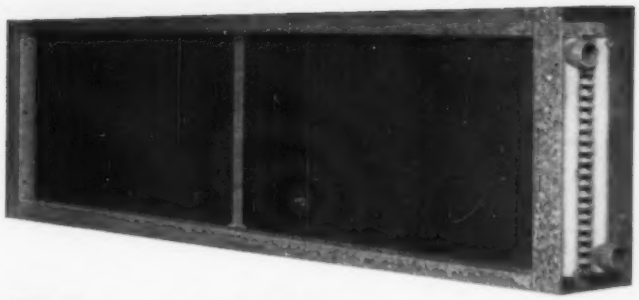
HM

Halstead & Mitchell

Water-Cooled Condensers · Cooling Towers · Air-Cooled Condensers · Finned Coil Products



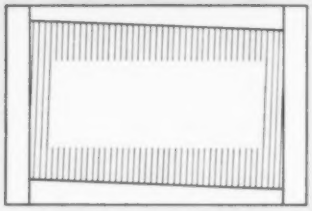
Nesbitt Type WD surface provides . . .

UNEXCELLED FREEZE PROTECTION

because it is the only Completely Drainable surface!

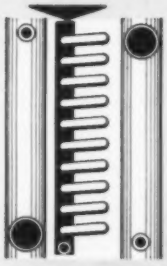
Here's Why!

CORE PITCHED IN CASING



By pitching the core in the casing 3/16″ per foot toward the water inlet end, water flows to the low point where it can be drained from Type WD surface.

AUXILIARY DRAIN HEADERS



In addition to drains in the main headers, Nesbitt also locates auxiliary drain headers at the low end of the section to remove every trace of water from Type WD surface.

IT'S A FACT . . . Nesbitt offers the only really drainable continuous tube water surface. Unlike conventional surfaces that rely on header and piping drains, Nesbitt Type WD water surface combines the effect of pitch (3/16″ per foot) with the use of auxiliary drain headers (in addition to main header drains) to assure positive drainage of all tubes and return bends. Every trace of water can be drained from the section . . . none can be trapped and subjected to subfreezing air. Consequently, Nesbitt Type WD surface provides unexcelled protection against freezing.

Get complete information on Nesbitt Type WD surface with all the benefits of conventional continuous tube water surface *plus complete drainability*. Write for Pub. 302.

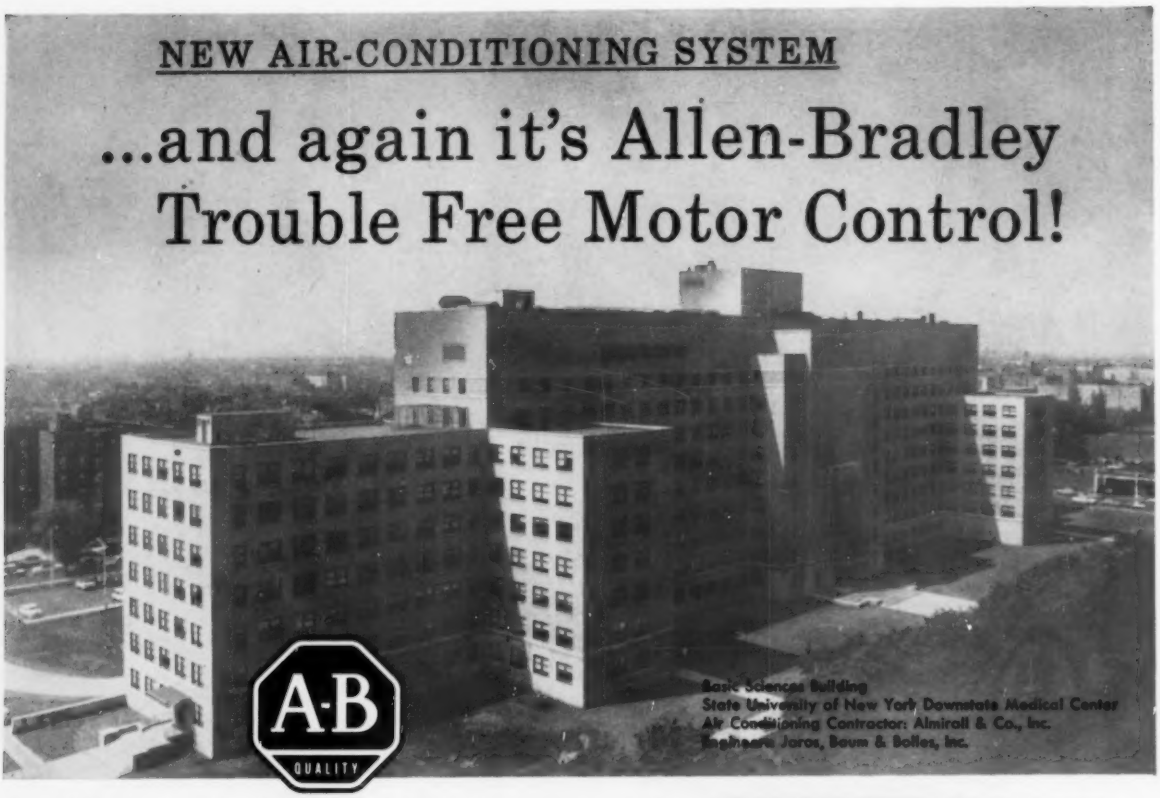
Nesbitt

Thermal Comfort All Ways

Made & Sold by John J. Nesbitt, Inc.
Philadelphia 36, Penna.

NEW AIR-CONDITIONING SYSTEM

...and again it's Allen-Bradley Trouble Free Motor Control!

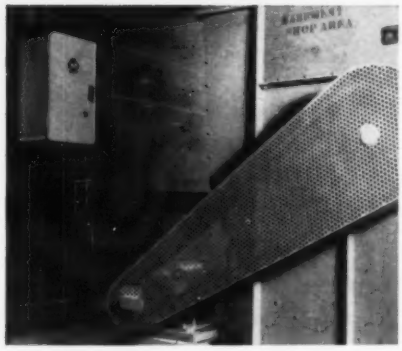


Basic Sciences Building
State University of New York Downstate Medical Center
Air Conditioning Contractor: Almiroll & Co., Inc.
Engineers: Jaros, Baum & Bolles, Inc.

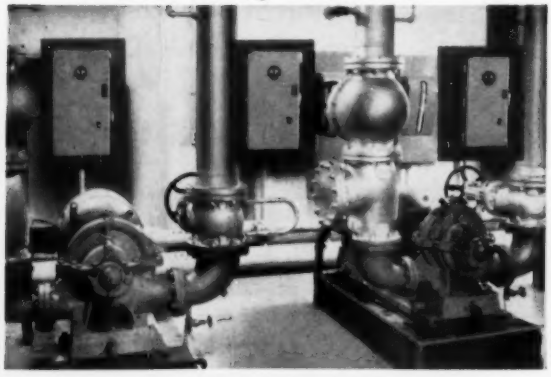
Consulting engineers—the men who *know* the importance of reliable performance—prefer to see Allen-Bradley motor control on *all* their jobs. Here's why: The simple solenoid design—exclusive with A-B in all starters up through Size 8—has only ONE moving part. This assures *years* of trouble free operation. A-B starters also have maintenance free, double break, silver alloy contacts and permanently accurate overload relays. All these features guarantee "user" satisfaction.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

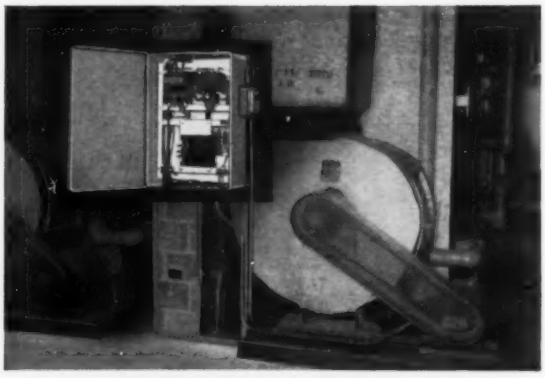
ALLEN-BRADLEY
MOTOR CONTROL
QUALITY



A-B Bulletin 646 manual reduced voltage, autotransformer starter for a 7½ hp fan motor.



Three A-B Bulletin 646 manual reduced voltage autotransformer starters used with the 50 hp condenser water pump motors.



One of three A-B Bulletin 746 automatic reduced voltage autotransformer starters for the supply and exhaust fan motors.

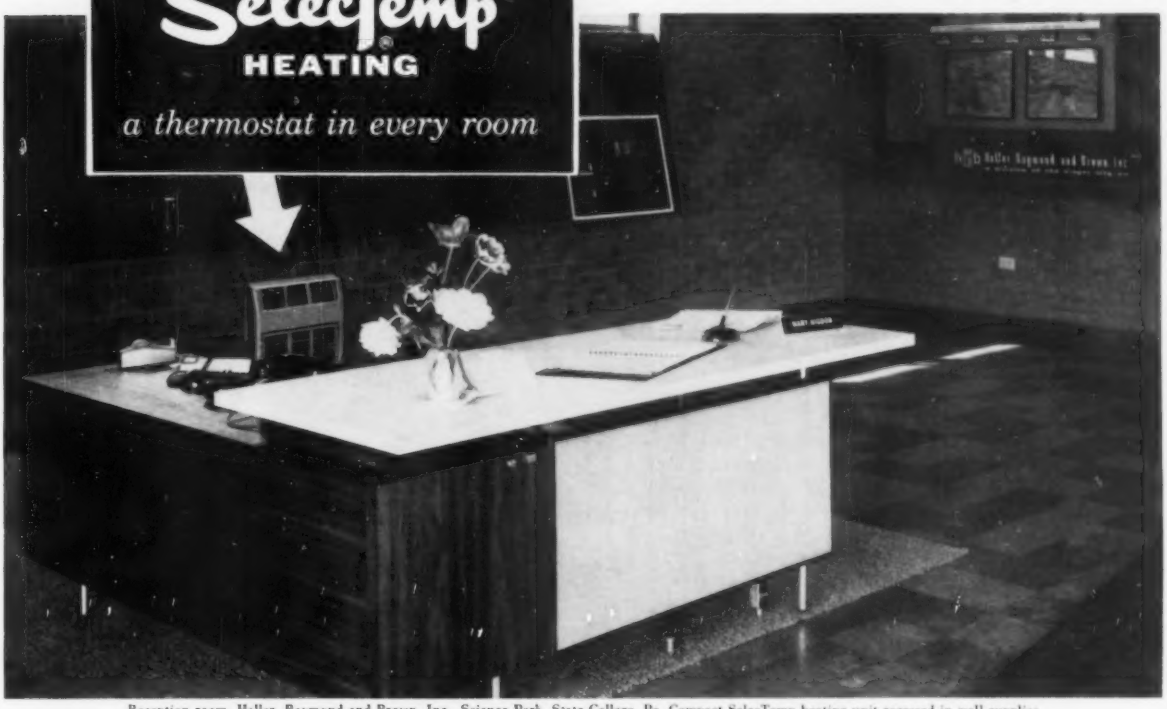
IRON FIREMAN

SelecTemp®

HEATING

a thermostat in every room

Architect, Horace Bailey, Johnstown, Pa. Heating Contractor, Stanton Barnhart, Johnstown.



Reception room, Haller, Raymond and Brown, Inc., Science Park, State College, Pa. Compact SelecTemp heating unit recessed in wall supplies as much heat as a big radiator, plus room-by-room temperature control and constant circulation of filtered warm air. No electric wiring required.

Prominent research firm praises new SelecTemp method of steam heating

Electronic scientists say, "SelecTemp more satisfactory than three other heating systems we have had"

"Outstanding features of SelecTemp heating are easy installation, efficient operation, low maintenance cost, very little deviation in room temperature, and individual room temperature control."

In these words Mr. Roy L. Smeltz, Plant Manager, sums up more than a year of experience with SelecTemp heating in the splendid new research building of Haller, Raymond and Brown, Inc., (division of Singer Manufacturing Co.) an organization of scientists and engineers engaged in electronics research for aeronautical and missile application.

Continues Mr. Smeltz: "In more than a year we have had only minor maintenance adjustments on three SelecTemp units out of 139. We are now completing a second building which has 89 units."

Two new research buildings of Haller, Raymond and Brown, Inc. are equipped with Iron Fireman SelecTemp heating, with a thermostat in every room.

No wasteful overheating; no uncomfortable underheating

The SelecTemp system provides steady, modulated warmth regulated by a thermostat in every room. Warm and cold sides of the building stay in perfect balance. With all of its advantages, SelecTemp costs no more than many systems that have no room-by-room regulation. Low maintenance costs and substantial fuel savings are a universal experience in SelecTemp heated homes and buildings. Steam for heat and steam-powered air circulation is supplied by a central low pressure boiler.

IRON FIREMAN®

Engineered

heating and cooling

Send coupon for full information

IRON FIREMAN MANUAFCTURING COMPANY
3163 W. 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

☐ Send SelecTemp specifications and full information.
☐ Arrange for brief demonstration of SelecTemp room unit, in actual operation, in our office.

Name_____
Firm_____
Address_____
City_____ State_____

For the first time!

Everything you need in Dial Thermometers for Piping *and* Duct work!

A new and complete line of instruments: Dial thermometer of Marsh precision and accuracy designed down to the last detail for piping and duct work . . . for use on heating and cooling equipment, air ducts, vessels and kilns, ovens and similar applications.

Easier to read

Illustrations tell the story. Four types, seven ranges—72 stock combinations to meet every condition. Big, legible 3½" and 4½" dials . . . easy to read in places where piping and duct thermometers must be installed. Ease of reading further increased by provision for tilting and turning dials to any desired reading angle. Line includes distant reading types that take care of remote locations.

Unbreakable—more accurate

Instead of fragile difficult-to-read glass tube thermometers you now have sturdy, unbreakable, legible Marsh Dial Thermometers. Guaranteed accurate to plus or minus one division of the scale, they have far greater *readable* accuracy than any glass tube type. All have the famous Marsh "Recalibrator"—to *keep* them accurate.

All purpose

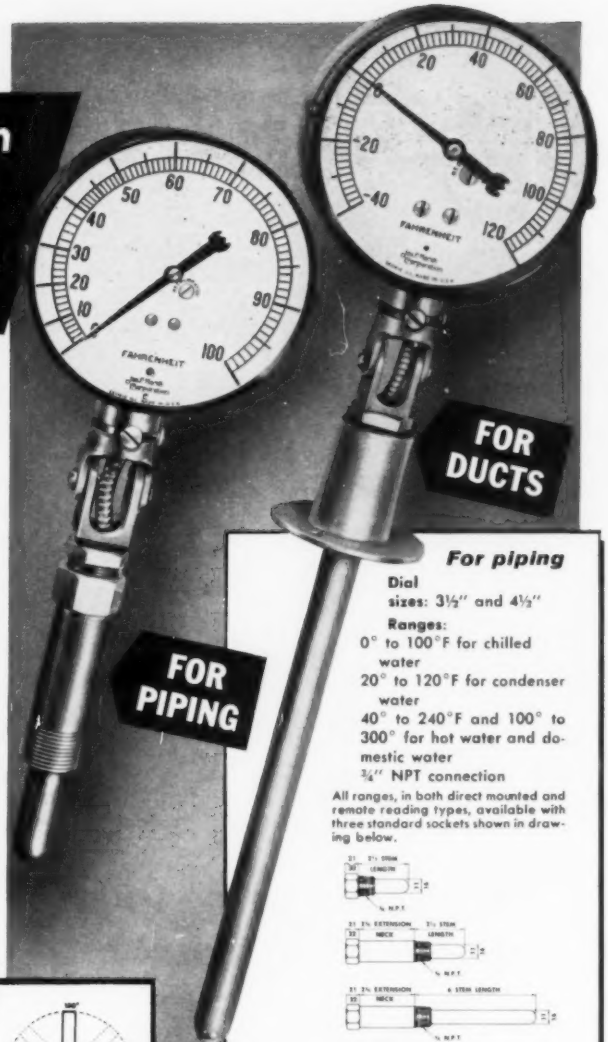
Design provides for every on-the-job condition. Separable sockets ("wells") simplify installation—or removal for servicing. Extension necks take care of insulation on piping or ducts. Long stems in duct type put temperature-sensitive section where it belongs.

Note the brief specifications opposite. Any thermometer is available from stock.

Write for bulletin telling the whole story.

Jas. P. Marsh Corporation
Dept. T, Skokie, Ill.

Marsh Instrument & Valve Co. (Canada) Ltd.
8407 103rd Street, Edmonton, Alberta



For piping

Dial sizes: 3½" and 4½"

Ranges:
0° to 100°F for chilled water
20° to 120°F for condenser water
40° to 240°F and 100° to 300° for hot water and domestic water

¾" NPT connection

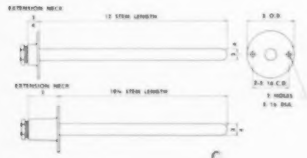
All ranges, in both direct mounted and remote reading types, available with three standard sockets shown in drawing below.

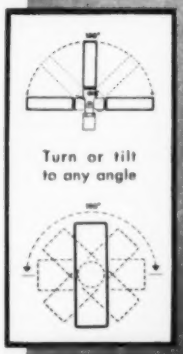
For ducts

Dial sizes: 3½" and 4½"

Ranges: −40° to +120° F
0° to 160° F
0° to 220° F

All ranges, in both direct mounted and remote reading types, available with standard extension necks and stems shown in drawing below.

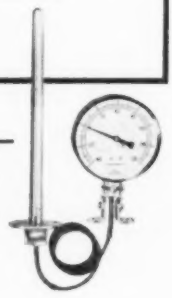




MARSH
DIAL THERMOMETERS

Also remote reading—

Piping and duct thermometers of same basic design available with 6 ft. of capillary tubing as shown.



quiet *vibrationless*

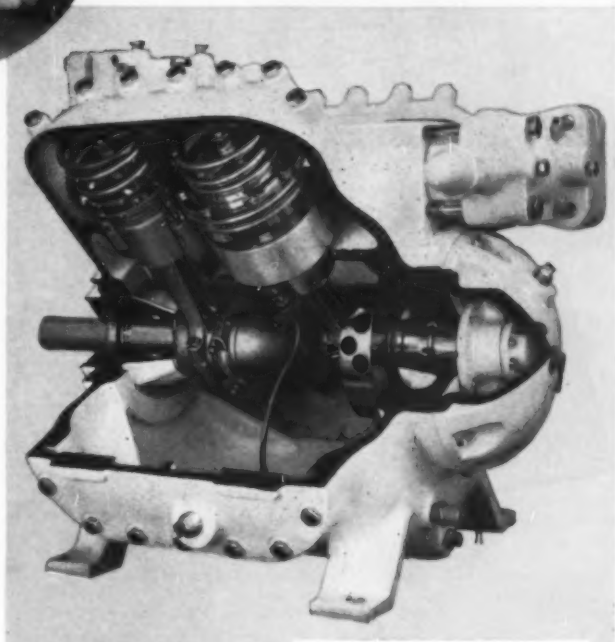
...A NEW COMPRESSOR TO MEET TODAY'S REQUIREMENTS

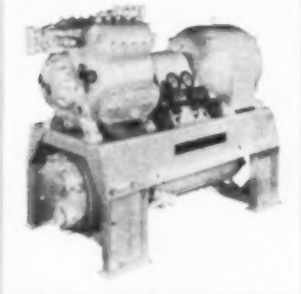
B&G Compressors are *not* adaptations of designs originated 20 years ago—they are completely new in conception, engineered to establish higher standards of performance. Foremost of their many features is quiet, vibrationless operation—and here B&G Compressors have no equal.

This is concrete evidence of quality! It indicates the precision manufacture of a basically superior design. B&G Compressors have fewer parts, present fewer maintenance problems. All units have *one* bore diameter—a few interchangeable parts will service them all.

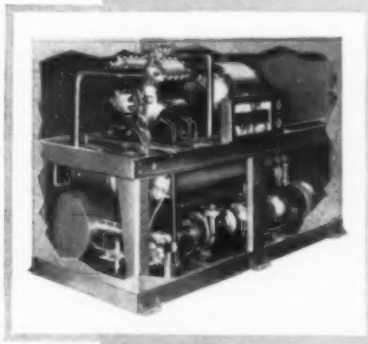
B&G Compressors can be equipped with multi-step capacity control systems. Standard equipment includes gas and oil equalization ports, magnetic plugs and oil sight glass.

All these things add up to greater efficiency—greater value per dollar. Remember, too, that all major parts of B&G "package" units are made and guaranteed by Bell & Gossett Company.





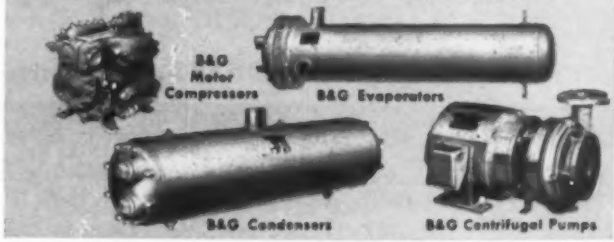
B&G Condensing Unit
An achievement in compact efficiency, featuring interchangeable vital parts. 7½ through 150 tons.



B&G Package Liquid Cooler
Completely integrated and assembled. Everything included, no extras to buy. 7½ through 150 tons.

Send for complete file of specifications and application data on B&G Air Conditioning and Refrigeration equipment.

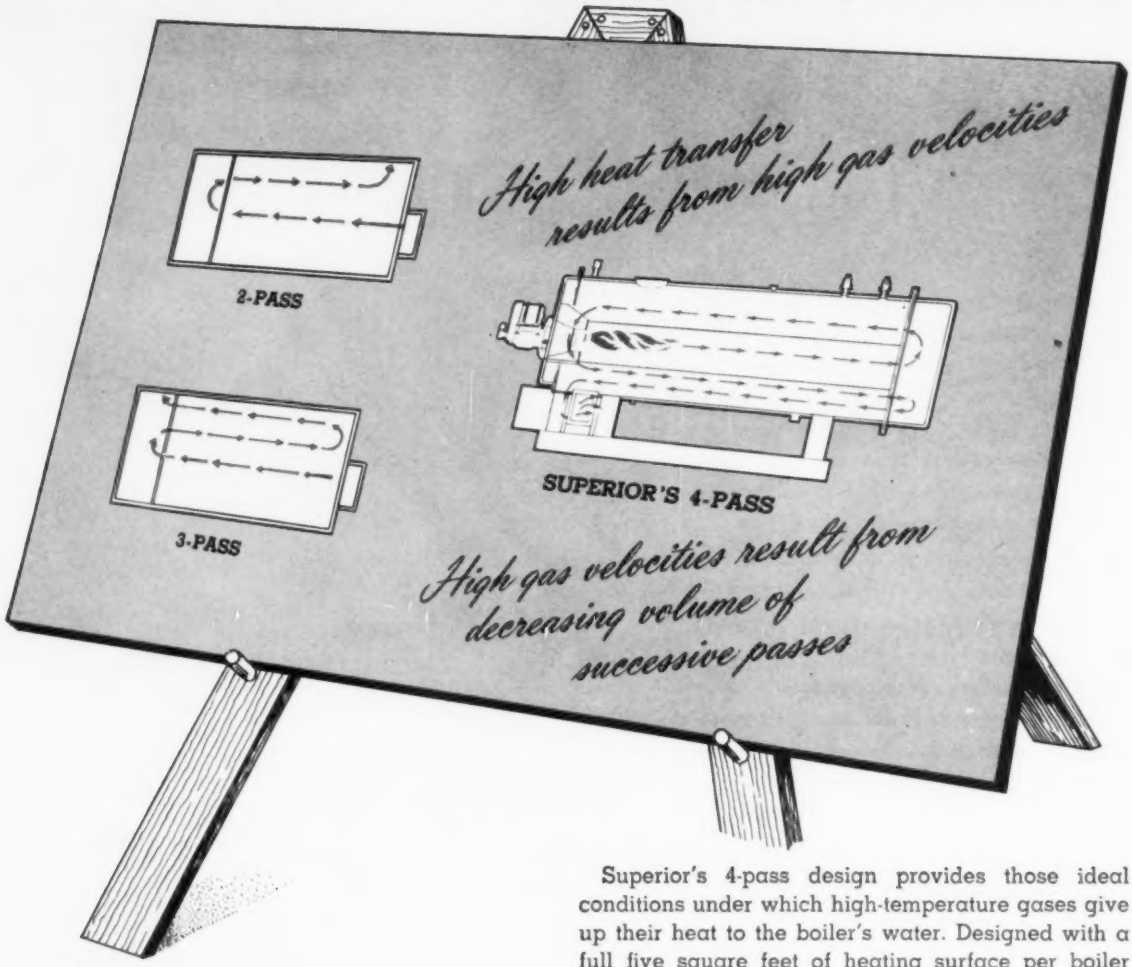
A COMPLETE LINE OF REFRIGERATION AND AIR CONDITIONING COMPONENTS



BELL & GOSSETT
COMPANY
Dept. RFU-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

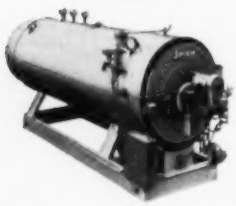
SUPERIOR'S 4-PASS DOWN DRAFT DESIGN

provides higher heat transfer


High heat transfer results from high gas velocities
2-PASS
3-PASS
SUPERIOR'S 4-PASS
High gas velocities result from decreasing volume of successive passes

Superior's 4-pass design provides those ideal conditions under which high-temperature gases give up their heat to the boiler's water. Designed with a full five square feet of heating surface per boiler horsepower, Superior boilers have reducing tube volume in successive passes. This reduced volume crowds the gases into intimate contact with the tube walls producing high velocities, and resulting in a continual scrubbing and cleaning action as the gases pass over the inner tube surfaces.

The down-draft arrangement of the 4-passes promotes the rapid steaming without surging, which results in dry steam . . . and in addition, this down-draft design traps the boiler heat during off periods, preventing its loss up the stack.



SUPERIOR "TYPE C" PACKAGED BOILERS

Completely packaged fire-tube units for capacities from 20 to 350 bhp. Rotary burners on all sizes. Induced draft for clean, quiet safe operation. Fully insulated and ready for service burning oil, gas or both in combination. Pressures to 250 psi, or for hot water operation. Other fire-tube models for capacities to 600 bhp. Write today for Bulletin 14C.

Specialists in PACKAGED BOILERS . . . exclusively

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS

Radiant Ceiling News

With Burgess-Manning Ceilings — Your Building Is Better — Your Building Budget No Bigger

Comfort "By the Dozen"

Birmingham, Michigan, now has twelve schools, built, building or planned, with Burgess-Manning Radiant Acoustical Ceilings

When a school board specifies, for a new school, a comfort conditioning system that differs quite radically from the conventional heating systems, it is news, but when that same school board, 6 years and 12 schools later, is still specifying Burgess-Manning Radiant Acoustical Ceilings, it is more than news, — it is positive proof of satisfactory, time tested performance.

Many Different Reasons for Choice

The variety of reasons given for this consistent preference is interesting in itself. — Superintendent, Principal, Teacher and Engineer, each had a different reason.

" — most unobvious and uniformly comfortable heating system we have ever experienced."

" — elimination of hot and bulky wall units provides more usable floor area."

" — children play on the floor and near the windows in complete comfort."

" — trouble-free, maintenance-free, instantaneous response, these make it a building engineer's dream."

The first Birmingham, Michigan, school to be equipped with Burgess-Manning Radiant Acoustical Ceilings, the Beverly Elementary School, designed by Eberle M. Smith Associates, Inc. of Detroit, received Honorable Mention Award in competition to aid school building design and dissemination of school plant planning with the A.A.S.A. and the A. I. A.

Economical in First Cost

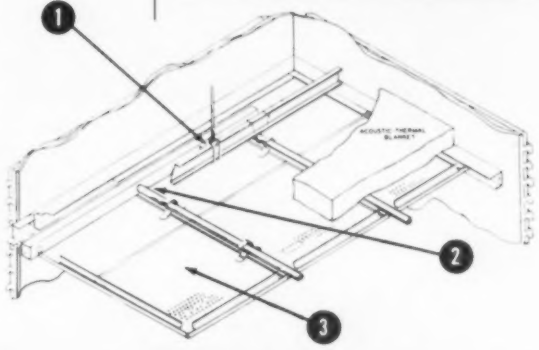
Nothing we could add would make the Burgess-Manning Radiant Acoustical Ceiling sound more advantageous and attractive in performance, but, when the architects, Smith, Tarapata, MacMahan, Inc., report that Birmingham's latest, the beautiful new Junior-Senior High School is now being built for $13.28 a square foot, ample evidence is also presented that the Burgess-Manning Radiant Ceiling can be used in tight budget jobs as well.

Consistently superior in performance — economical in first cost and installation costs — these features account for the growing number of institutional and commercial structures being comfort conditioned by the Burgess-Manning Acoustical Ceiling.

Basically Simple Construction of Burgess-Manning Radiant Acoustical Ceiling

This isometric drawing illustrates the compact assembly of the four primary parts of the ceiling and the relatively simple, easily erected construction.

A standard 1½" channel suspension grid(1), supports the water circulating coil (2), made from pre-fabricated headers to which ½" laterals are welded. The perforated aluminum panels(3), are fastened directly to the coil. These panels are finished in easily maintained baked enamel. A sound absorbing blanket is laid over the channel grid. The whole assembly is only a space - conserving, 3⅛" in depth.



Write for descriptive Burgess-Manning Catalog No. 138-2H

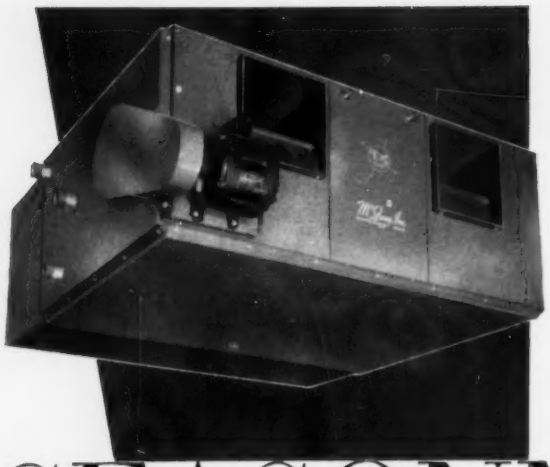
3 Heating Cooling Acoustical

BURGESS-MANNING COMPANY

Architectural Products Division

5970 Northwest Highway, Chicago 31, Ill.

SEE OUR CATALOG IN SWEET'S ARCHITECTURAL FILE OR WRITE FOR COPY

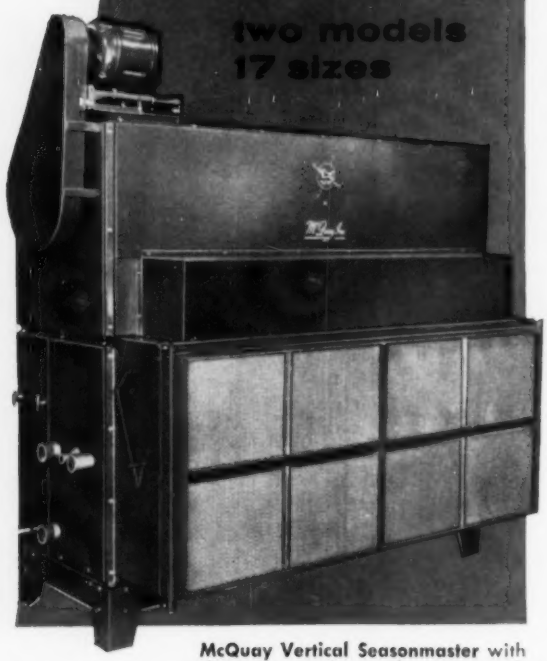


McQuay Horizontal Seasonmaster with water coil, steam coil, face and by-pass, and flat filter section. Removable panels permit complete accessibility for inspection or service. Horizontal models available in 17 sizes, ranging from 640 to 38,100 cfm.

McQuay SEASONMASTERS

for year 'round comfort

two models
17 sizes



The most universal line of air conditioners in the industry

The McQuay line of Seasonmaster central station air conditioners is truly universal. It is the most versatile, the most flexible and the most complete in the industry. McQuay Seasonmaster units will both heat and cool, filter, humidify and dehumidify, when furnished with steam, water heating, water cooling or direct expansion coils in capacities from 640 to 38,100 cfm. A full line of accessories is available for any heating or cooling combination.

For small or large area air conditioning, look to McQuay. Compare the versatility, compare the quality and performance and compare the range of models. And always remember, only McQuay gives you Ripple-Fin coils, Dura-Frame construction and Galva-Seal bonderized, baked-on enamel finish. See the McQuay representative in or near your city or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

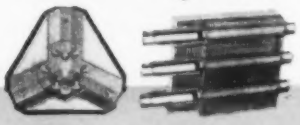
McQuay Vertical Seasonmaster with direct expansion coil, steam coil, face and by-pass, and flat filter section. Heavy gauge galvanized channel framework to form a rigid structure. Sixteen sizes are available, ranging from 640 to 29,000 cfm.

McQuay INC.

MAKE THE SEASONS COME TO YOU

AIR CONDITIONING • HEATING • REFRIGERATION

McQuay Means Quality



McQuay units feature the exclusive Ripple Fin Coils which create maximum air turbulence and have wide, full fin collars that act as automatic spacers to form a tube around the coil tube for positive, permanent bond, greatest heat transfer and protection. The Dura-Frame "V" channel construction provides the strength and rigidity necessary for quiet, trouble-free operation.

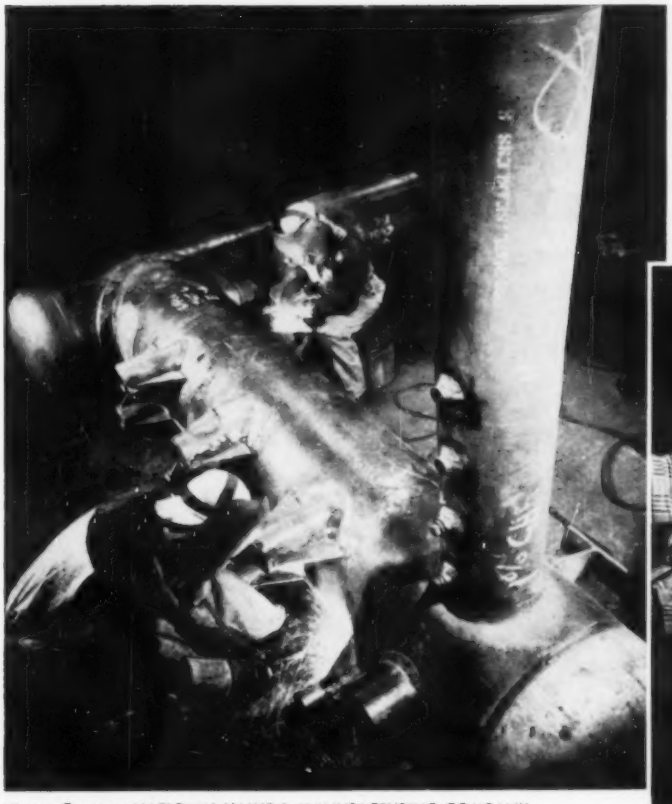
ATOM·ARC* Pipe Welding Alloys

*IRON POWDER LOW HYDROGEN ELECTRODES

provide x-ray quality welds—lower welding costs at

NATIONAL VALVE AND MANUFACTURING CO.

less rework, no grinding or chipping, faster deposition rates, are time savers that boost profits.



Photos Courtesy NATIONAL VALVE & MANUFACTURING COMPANY

National Valve and Manufacturing Co., fabricator and erector of quality piping for American industry, has consistently been among the leaders in the piping industry for the last half century. This large, engineering-minded organization maintains its position of leadership through research to constantly improve methods and facilities—testing and selecting the latest in materials that will provide their clients with the finest quality high pressure, high temperature piping.

NAVCO research into welding techniques and materials resulted in the selection of ATOM·ARC All Position Iron Powder Low Hydrogen alloys for handwelding of pipe fabrications and for field erection. The X-ray quality of ATOM·ARC weld metal eliminates needless rework. The flat, smooth bead contour makes slag removal easy, requires no costly and time consuming chipping and grinding, allowing weldors more time for welding. Even finish grinding of the final pass is eliminated. These cost saving properties of ATOM·ARC electrodes are amplified by the fast deposition rate achieved from the iron powder type coatings.

These are the facts NAVCO found in their search for better materials for high quality piping . . . facts which prove ATOM·ARC Iron Powder Low Hydrogen Alloys produce superior piping products. For your free copy of an informative and revealing report to piping contractors, write to:

Alloy Rods Company, P. O. Box 1828, York 59, Penna.

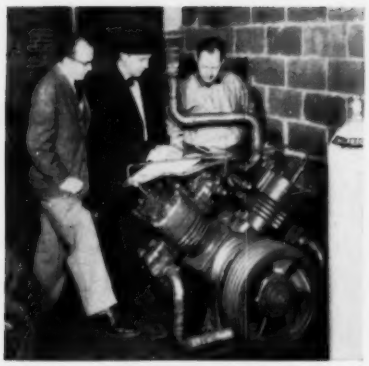
WORLD'S LARGEST SELECTION—IRON POWDER ALLOYS

ATOM·ARC 7018 Mo	AWS E7018-A1
ATOM·ARC 8018 N	AWS E8018-C2
ATOM·ARC 8018 CM	AWS E8018-B2
ATOM·ARC 9018 CM	AWS E9018-B3
ATOM·ARC 10018 MM	AWS E10018-D2
ATOM·ARC 12018 NMV	AWS E12018-G
ATOM·ARC "T"	AWS E11018-G
ATOM·ARC 502	AWS E502-16

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

NO FINER ELECTRODES MADE . . . ANYWHERE



Baltimore, Maryland, service engineer reports: "'Freon' refrigerants help us do a better servicing job. It's dry and safe—the most dependable refrigerant on the market today."

East Rockaway, New York, contractor reports: "Nothing works like 'Freon'. I'm convinced it's the best refrigerant on the market—safe and dependable for any job."

Louisville, Kentucky, service man reports: "'Freon' is the world's best refrigerant for our money. It's pure, dry and safe—never causes one bit of worry or trouble."

Atlanta, Georgia, contractor reports: "We've never had a bad batch of 'Freon' in the 25 years we've used it. It's never caused us trouble on the job or—after years of service—in a system."

Tucson, Arizona, service man reports: "'Freon' refrigerants help us do the best job possible. They're reliable and safe. Since 'Freon' came out, we've never used anything else."

St. Louis, Missouri, service man reports: "We've never had a moisture or corrosion problem in equipment charged with 'Freon.' It's absolutely dependable—always pure and dry."

All over the country, users are talking about the advantages of Freon* refrigerants

East, west, north or south—contractors and service men appreciate the extra quality of "Freon" refrigerants that costs them nothing extra.

"Freon" is today's premium-quality refrigerant . . . stable, pure, dry—nonflammable, nonexplosive, nontoxic. It's time-tested—in use over 27 years and made only by Du Pont—backed by years of technical and manufacturing leadership.

Specify "Freon" refrigerants for every refrigerant need. Your Du Pont wholesaler has it—now capped in gold and factory-sealed to guard its purity till you're ready to use it.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

FREON® *premium quality* **REFRIGERANTS**

**Freon and combinations of Freon- or F- with numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.*

Heating Piping & Air Conditioning

July 1959

You'll Want To Know...

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

CEC Covers Wide Agenda At Annual Board Meeting

OVER A PERIOD of four days, the Consulting Engineers Council recently dealt with an agenda of 60 items of major importance to engineers engaged in private practice at its third annual board of directors meeting.

In the course of the meeting, the following five actions were taken by the Council's board:

1) Answer of a request from the National Council of State Boards of Engineering Examiners for a statement of policy with regard to corporate practice. The result was a resolution accepting incorporation of engineering firms where ownership and continuing control are in the hands of legally registered professional engineers.

2) Notification of a "sleeper" in H.R. 5915, the Department of Interior appropriations bill, calling for a 5 percent maximum on all engineering fees, resulted in the immediate dispatch of some 25 telegrams to various congressmen urging that this provision of the bill be dropped.

3) Applications for membership in the Consulting Engineers Council received from consulting engineer organizations in Florida, Montana, Pittsburgh, and Wisconsin were approved on the spot, with representatives of each group seated as full members of the board.

4) Refusal of a leading manufacturer to discuss company employee engineers use of the title "Consulting Engineer" prompted the sending of a telegram to the president of the firm requesting that a representative be named to attend the CEC meeting and sit in on discussions of this subject. The vice president of the company's New York office met with the Council the day following and positive action on the matter is "expected to be forthcoming."

5) The proposed placement of Illinois Engineering Registration Boards under that state's Department of Labor prompted the immediate preparation and adoption of a resolution requesting, among other things: (a)

RALPH M. WESTCOTT, newly elected C.E.C. president, addresses Council at its recent New York City annual meeting

that independent public engineering be bodies under the jurisdiction of no special department of the State government; (b) that personnel of such bodies be nominated by professional engineering groups within the state; and (c) that all such personnel be restricted to registered professional engineers.

Standard forms of agreement for use between architect-engineer and engineer-owner were introduced by the documents committee chairman, George Poulsen, Jr., of Salt Lake City. These forms are now in the process of being printed and will soon be available for distribution from the Council's Springfield, Ill., office.

Newly elected vice president, Thomas R. Miles of Beaverton, Ore., presented the first draft of a comprehensive C.E.C. Manual of Practice, which seeks to clarify in one volume: various steps in performance of services; specific problems in ethics; recommended schedules for fees; standards for establishing office overhead; and relations with employees, clients and other consulting engineers.

Outgoing treasurer B. M. Dornblatt, of New Orleans, reported on the Council's professional liability insurance program, describing it as being "well off the ground with about $200,000 now being paid in annual premiums."

Highlights of the four day session were provided by two eminent speakers. At the opening luncheon, the American Institute of Architects president, John Noble Richards, discussed the responsibility and role of the architect and engineer in today's and tomorrow's society. Mr. Richards stated his belief that increased cooperation between the two professions would materially benefit the client as well as the architect and the engineer.

Principal speaker at the annual installation of officers banquet was Julian S. Tritton, president of the International Federation of Consulting Engineers, from London, England to welcome C.E.C. as the newest member of that organization. Mr. Tritton, a prominent engineer, discussed the problems and practices of consulting engineering on an international scale. The recently approved international conditions of the contract were also presented and discussed as a part of his address.

Among the subjects covered in the report of outgoing president C. C. Pate to the meeting of the Consulting Engineers Council, was a commentary on the timely problem of "free engineering."

"Both sides of this controversy have problems," said Mr. Pate. "Under our free enterprise system there is no legal approach to this problem. It is strictly one of economics. Engineering firms are partly to blame for this condition due to their demand on the manufacturer for, in some instances, detailed plans for a project. That is the responsibility of the consulting engineer, and due to these rare requests the manufacturer has built up service organizations for peak loads, and has on occasion offered these services at no cost to the client so they can control the specifications.

"This is a program that can be undertaken only with patience and a desire on the part of the committee to analyze the problems of both the consulting engineer and the manufacturer and, through negotiations and compromise, to work out an agreement that can be acceptable by each even though it might not be completely satisfactory to either. This," Mr. Pate concluded, "is strictly a public relations program."

Contained in the documents committee report board of directors was news that some work has been accomplished on mechanical-electrical special conditions to be used in conjunction with the C.E.C. or American Institute of Architects general conditions.

"Under Edgar L. Galson," said the report, "the previous efforts of all parties to prepare such mechanical-electrical special conditions are being gathered together with the intent to publish them under the sponsorship of the Council in a standard set of mechanical-electrical special conditions. It is expected that during the 1959-60 fiscal year these Special Conditions will be copyrighted and published by Consulting Engineers Council."

You'll Want To Know

ASA Gas Piping Code Available from ASME

THE LATEST EDITION of American Standard Code for Gas Transmission and Distribution Piping Systems, ASA B31.8-1958, has been approved by the American Standards Association and published by the American Society of Mechanical Engineers.

The code is section 8 of the American Standard Code for Pressure Piping, which is directed by ASA sectional committee B-31. This committee, sponsored by ASME, has established an orderly procedure for revision of the code through the issuance of "cases." These are the committee's replies to requests it has received for interpretation. (Note: these cases are published from time to time in Heating, Piping & Air Conditioning.)

The Code for Pressure Piping deals primarily with engineering requirements for safe design and construction of piping systems. The committee points out that it is not a design handbook, but that it does contain basic reference data and formulas necessary for design.

Copies of American Standard Code for Gas Transmission and Distribution Piping Systems, ASA B31.8-1958, are available at $2.50 a copy from American Standards Association, 70 E. 45th St., New York 17, or from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

All-Time High in Construction Continues Rise

CONSTRUCTION CONTRACTS in the U. S. in the month of April totalled $3,778,419,000, setting a new high for any April, and a new all-time high for any month, if allowance is made for seasonal influences, according to F. W. Dodge Corp.

Virtually every type of construction gained in April. Particularly encouraging were big increases in contracts for schools and factories, two large categories of nonresidential building which had been lagging earlier in 1959. Manufacturing building contracts in April were up 46 percent from April of last year, and school contracts were up 15 percent.

Total construction contracts in April, at $3,778,419,000, were 31 percent above the April 1958 level.

Contracts for nonresidential buildings in April amounted to $1,187,200,000, up 24 percent from a year ago. In addition to the increases in contracts for manufacturing buildings and schools, all other major nonresidential building types also scored impressive gains over the like 1958 month.

No Health Threat Offered by Present Radiation Level

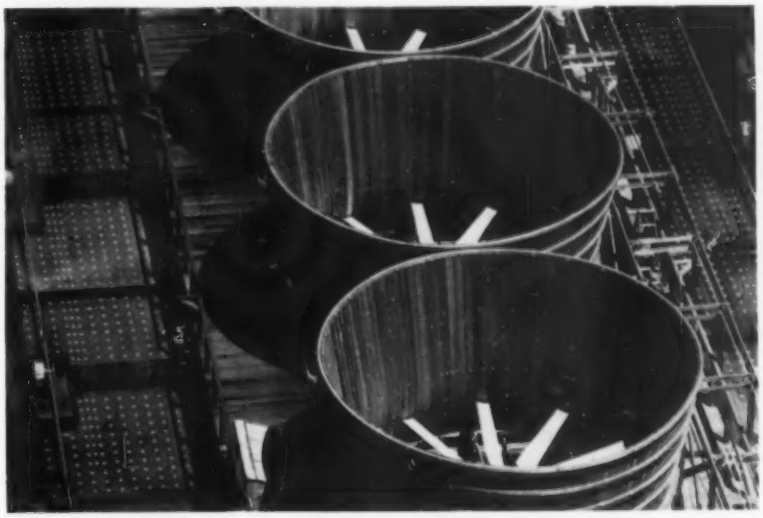
PRESENT LEVELS of radiation from natural and artificial sources do not constitute a health danger today, said Dr. Austin M. Brues, director of the Division of Biological and Medical Research at Argonne National Laboratory.

Speaking before the 16th annual Industrial Health Conference, recently held in Chicago, Dr. Brues stated that, "Current levels of radioactive fallout are not dangerous, and the permissible exposure limits that have been established do not mean a line has been drawn between safety and catastrophe."

He said current levels of radioactive fallout are much lower than natural background radiation that has been present in man's daily environment for centuries.

"The big question today is whether small amounts of radiation produce a few cases of cancer or leukemia in large populations," Dr. Brues continued. "Estimates range all the way from no effect to sizeable numbers, provided the population under consideration is large.

"Cigarette smoke or auto exhaust fumes are more likely to produce cancer than the small amounts of radiation we receive," concluded Dr. Brues.



Use of Chlorine in Wood Cooling Towers Condemned by Redwood Association

THE BASIC CONCLUSIONS drawn from the California Redwood Association's eight year study of the causes and means of preventing premature failure in redwood cooling towers have recently been compiled and are now available.

Early in the CRA study it was determined that the excessive use of chlorine, combined with alkaline circulating water, was responsible for very rapid delignification, which was causing premature failures in some towers.

Shortly thereafter, the CRA suggested the possibility that adding even small amounts of chlorine to the circulating water had a deleterious effect on wood's ability to resist biological attack. At first, this idea was widely discounted, but as increasing confirmation was obtained in the form or field data, it gained wider acceptance, according to the association.

A recent report prepared by the California Redwood Association concludes that, "The surface deterioration of redwood in cooling tower service may virtually be eliminated by avoiding the use of chlorine and using a non-oxidizing algaecide in the treatment of the circulating water." The report added that, "The tendency for internal decay to develop will be reduced by the same water treating practices which control surface deterioration."

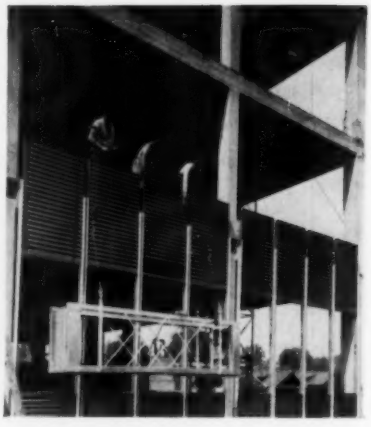
A copy of this report on the study of cooling tower wood maintenance may be obtained from the Technical Div., California Redwood Association, 576 Sacramento St., San Francisco 11.

You'll Want To Know

Aluminum Louver Sections Provide Intakes for Individual Units

THE NEW SEVEN STORY Standard Life Insurance building in Indianapolis has an exterior entirely constructed of reversible, double hung glass window sections and fixed aluminum louvers covering intakes for room air conditioning units for each office space in the building.

In designing the air conditioning system, individual units were employed in accordance with the owner's wishes in order to eliminate all duct work on the office floors. In areas where no air intake is needed, the rear of the louvers was blocked with aluminum sheet panels and insulation was installed.



A coating of lacquer was applied to all the louvers as a final step in manufacture, according to Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co. The lacquer is applied for protection of the anodized surface of the aluminum against corrosion during and after construction.

Thermoelectric Research Inaugurated for Navy

DESIGN STUDIES to test the feasibility of thermoelectric heating and cooling in shipboard air conditioning will be undertaken by Carrier Corp. under a contract from the U. S. Navy.

The 18 month program contemplates preliminary design and analysis. Successful completion will lead to large scale development of thermoelectric heat pumps containing no moving parts. Similar devices can be used to generate electricity directly from heat, also without moving parts.

Thermoelectric air conditioning is based on the principle that applying an electric current to a circuit in which dissimilar materials are joined causes one junction to become hot while the other becomes cold. Thus cooling can be produced at one point and heating at a second.

Although the principle has been known for many years, lack of efficient thermoelectric materials has slowed development. Only relatively small and primarily experimental heating and cooling devices have been produced to date.

You'll Want To Know

Set Air Force Meeting on Air Conditioning for July

A CONFERENCE OF U. S. Air Force personnel responsible for all policy, as well as operation, maintenance, repair, and minor construction of refrigeration and air conditioning equipment at Air Force installations throughout the world will be held at Wright-Patterson Air Force Base, Dayton, Ohio, July 13-16, it is announced by William T. Smith, chief of the air conditioning and refrigeration section, headquarters, U. S. Air Force.

A program of discussions of air conditioning and refrigeration problems by the Air Force personnel will be augmented by speakers from the industry and a panel discussion in which industry technicians will participate.

Degree-Day Data Published by API

A TWO VOLUME "Handbook of Degree-Day Data for the United States" was recently published by the American Petroleum Institute to help heating engineers in making seasonal fuel consumption estimates.

The handbook gives degree-day data for 171 stations in the U. S., based on a compilation of readings taken at each station over the past 30 years. This statistical approach has made it possible to establish realistic mean heating seasons for the various locations. A standard plus-and-minus deviation has been worked out which, by addition to or subtraction from the mean sets up degree-day ranges into which certain percentages of past heating seasons have fallen.

The handbook, intended to help in the estimation of fuel needs, local degree-day ranges and the frequency of extreme conditions, may be obtained direct from the American Petroleum Institute, 50 W. 50th St., New York 20.

Air Conditioned Cars Speed Salesmen on Calls

ACCORDING TO a recent survey taken among nearly 400 E. I. du Pont de Nemours & Co. salesmen assigned mechanically cooled cars, it was found that 92 percent felt that the air conditioning helped them to do a better job on customer calls.

Improved personal appearance, greater comfort, and a "more relaxed, better disposition" were benefits mentioned. Other advantages cited included the reduction or elimination of traffic noises, drafts, dust, and odors because car windows can be kept closed. More than a third of the drivers of air conditioned cars said they felt that the mechanical cooling fatigue and keeping them more alert, made them safer drivers by reducing

Only 35 percent of the drivers in the study cited minor dissatisfactions.

A company spokesman predicted that within the next few years auto air conditioning will show rates of growth similar to those of automatic transmissions, built into four out of five automobiles manufactured since 1955, and power steering and power brakes, which have been standard equipment on 35 percent of U. S. cars turned out in the last four years.

SBI-IBRM Merger Abandoned for New SBI Expansion Plans

THE PROPOSED MERGER between the Steel Boiler Institute and the Institute of Boiler and Radiator Manufacturers has been abandoned in favor of new plans by SBI for expanded activities and programs, it was recently announced by Edmund J. Grady, newly elected president and chairman of the Steel Boiler Institute's board of directors.

Mr. Grady, who is also vice president of Pacific Steel Boiler Div. of National-U. S. Radiator Corp., said the association will enlarge the scope of its activities alone. "It was the feeling of the members at the recent annual meeting of SBI that a number of projected industry plans could best be carried out by SBI itself," Mr. Grady reported.

It was announced by the engineering committee that in the immediate future a new issue of the SBI Rating Code will be released. A new special section will list SBI ratings for boiler-burner units.

In addition to Mr. Grady, other new officers elected at the annual meeting were: vice president, Fred S. Hudson, Jr., National-U.S. Radiator Corp., and secretary-treasurer, R. A. Locke. Elected to serve three year terms on the board of directors were: A. J. Hall, Burnham Corp.; J. F. Johnston, Jr., Johnston Bros., Inc.; and J. F. Sweeney, Titusville Iron Works Co.

The completion of a corrosion testing program, conducted for the past several years at Babcock & Wilcox Co. tubular products div. laboratory, was also announced at the annual meeting. Findings pertaining to causes of internal boiler corrosion and methods of prevention have been compiled and will be presented shortly, it was reported.

Increased activity was reported in the Better Heating-Cooling Council's promotional program for the use of hydronic heating in school, apartment and office buildings, and other commercial and industrial structures.

Gas-Fired Radiant Heating System Warms Indianapolis Garage

A NEW SYSTEM of radiant heating used in Terminal Transport Co.'s Indianapolis garage maintains a 70 F temperature, with the floor of the garage 2 F warmer than the roof, according to Perfection Industries, Div. of Hupp Corp.

Nine gas-fired radiant heat generators hung from the roof beams 15 ft above the floor heat the 3648 sq ft floor area of the corrugated steel structure with its quonset type roof with many cracks and air crevices. Two small units are used in the washroom and office. Propane is used to supply the heaters because of utility company restrictions on the use of natural gas.

The generators consume fuel at a rate of approximately 12,000 Btu per hr per unit, producing a radiating surface of 1600 F. There are three units in each of the nine heaters.

CBRA Releases "Ominous" Report on Post-War Brass Mill Product Imports

A COMPREHENSIVE STUDY spelling out the "ominous" impact of postwar U. S. international economic policies on U. S. brass mills has just been released by the Copper & Brass Research Association.

The study includes: (1) an evaluation of the brass mill industry's significance in the overall U. S. economy; (2) an analysis of U. S. international trade in brass mill products; (3) an exploration of the policies of the U. S. and various foreign nations with respect to international trade; (4) a recommendation that U. S. international policy be changed to include a flexible tariff which will permit domestic basic industries, such as the brass mills, to compete on even terms with foreign suppliers in U. S. markets.

Complete with charts and statistical data to illustrate and amplify its major contentions, the 47 page study shows why the U. S. postwar 'dollar gap' policy has adversely affected basic U. S. industries. While acknowledging that the purpose of the 'dollar gap' policy—the prevention of the spread of communism abroad through economic aid—is laudable, the study contends that the policy has been

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administered in a much less than laudable manner.

For example, the study points out that the policy is applied to basic industries as if they were of little importance to our economy and to our national defense. Moreover, the policy is unfair, the report continues, because it forces domestic brass mills to compete with foreign mills which pay low wages which would be unlawful in this country.

The 'dollar gap' policy also is unwise, notes the study, because friendly nations shipping brass mill products to the U. S. are being led down a blind alley. "Ultimately," it states, "a halt must be called to these imports in order to preserve an essential domestic industry; if these friendly exporting nations have in the meantime built up their brass mill capacity on the expectation of selling in American markets, the blow to them will be much more severe in the future than (it would be) now."

These unfavorable aspects of the 'dollar gap' policy, the report further explains, have had these effects:

1) An alarming growth in brass mill imports with the loss of almost 100 percent of certain markets such as tubular plumbing goods.

2) The conversion of the U. S. from a net exporter to a net importer of brass mill products.

3) The gradual displacement of U. S. brass mill labor with foreign labor which is paid only a fraction of American wage rates.

In conclusion, the report urgently pleads for a new policy on imports. "Such a policy," it emphasizes, "should distinguish between basic industries vital to our national economy and industries that are not. The policy should also encourage foreign producers to raise the level of their wages to more nearly that of our own.

"This could be accomplished by means of a flexible tariff which would merely equalize the wage disparity between foreign and domestic producers."

You'll Want To Know

Incandescent Spot Lamp Simulates Sun in Texas Natural Lighting Studies

A 5000 WATT incandescent spot lamp is being used at the Texas Engineering Experiment Station, College Station, Texas, to enable architectural researchers to simulate the sun in natural lighting studies of scale model buildings.

The spot lamp is used to project a beam of light onto a model placed on a large table which can be adjusted to any sun angle. This experimental procedure allows researchers to study light intensity, distribution, brightness, and other related factors inside the scale model building, without the changing effects of actual weather conditions. An intensive study of plastic dome skylights is now under way to determine typical spacing, material types for skylights, and other lighting characteristics.

Studies are also under way to determine the effects of shrubs, grass, trees, sidewalks, and other landscaping devices on the interior lighting of the scale model. It has been found that landscaping elements can be very effective in controlling excessive brightness caused by sunlit objects just outside of buildings.

The electric sun lamp is to be used in studies of solar radiation to determine the effects of various building elements on radiation, and inside comfort conditions. Used in conjunction with these studies are various radiation instruments such as pyrheliometers and directional thermopiles.

Gas Reserves Climb to 2.7 trillion cu ft

THE GAS UTILITY and pipeline industry has boosted its underground reservoir capacity to 2.7 trillion cu ft, the American Gas Association announced.

In a report before delegates to the association's annual Transmission Conference, Lylse R. Kirk, chairman of AGA's subcommittee on underground storage statistics, said the industry had nearly 1.8 trillion cu ft of gas in storage at the end of 1958.

AGA's eighth annual underground storage report shows that four states—Pennsylvania, Ohio, Michigan and West Virginia—account for more than two-thirds of the total gas in storage reservoirs at year-end. A total of 205 storage pools and 8237 active wells operate in 19 states, up from 199 pools and 7969 wells a year ago.

Similar expansion is reported for compressor stations required for underground storage operations. The 130 compressor stations in 1957, with 411,000 total hp, have increased to 136 stations with 438,000 hp.

Two states showed "exceptional growth" in storage last year, the gas association reported. Iowa's gas in storage more than doubled, climbing from 13 to 31 billion cu ft, while Texas increased from 26 to 38 billion cu ft.

ARI Disbands Section on Room Air Conditioners

THE Room Air Conditioner Section of the Air Conditioning and Refrigeration Institute was disbanded recently by a vote of ARI's board of directors.

ARI and the National Electrical Manufacturers Association, which recently formed its own Room Air Conditioner Section, have recently discussed their common interests in many matters, including equipment standards and federal excise taxes. The two groups have agreed to form a liaison committee made up of members of both to further discuss and consider matters of common interest.

Need Particulate Sampling Device: Armed Forces

A LIST OF 28 new devices or systems needed by the Armed Forces was released recently through the National Inventors Council by the U. S. Dept. of Commerce.

The appeal made to the nation's civilian inventors called for inventions needed ranging from a rocket lift device to be worn by a single individual to small electronic components.

Of special interest to the heating, piping and air conditioning field was the request for a "particulate sampler." The device needed was described as, "A sampling device or set of samplers that can be used in the field to sample either liquid or solid particulates from a cloud of such material within discrete size ranges over a total range of 1 to 100 micron diameters." The bulletin went on to add, "It would be desirable that the device sample as a function of time either sequentially or continuously, although total sampling would be valuable."

The bulletin, "Supplement to Technical Problems Affecting National Defense," and a basic list of older, still unsolved problems may be obtained by writing to the National Inventors Council, U. S. Dept. of Commerce, Washington 25, D. C.

Nuclear Pipe Welding Treated in AWS Book

THE FIRST national publication dealing with welding nuclear piping has just been completed by the American Welding Society Committee on Piping and Tubing.

The report indicates what changes in welding changes are made necessary by the application to nuclear service of materials now used for pressure piping in non-radioactive service. It contains diagrams showing specific joints details, as well as information on electrodes, cleanliness, and inspection. Copies will be available shortly from the American Welding Society.

New Overhead Revolving Heater System Holds Plant Temperature at Even Level

A SYSTEM OF OVERHEAD revolving heaters has been installed throughout the manufacturing facilities of Republic Rubber Div., Lee Tire and Rubber Co. which use steam at 145 psig. The delivery temperature of the air in the discharge outlet is 124 F. By the time the air streams reach floor level, mixing with room air has reduced them to normal room temperature, according to L. J. Wing Mfg. Co.

The heaters are designed to use steam at any normal plant pressure from 3 to 150 psig. When using 3 psig steam, a full set of tubes are installed. At a higher pressure, fewer tubes are required to hold the discharge temperature at the same level.

Joint Industry Program Committee Approves Clear Specification Resolution

THE SEVEN ASSO. ATIONS comprising the Joint Industry Program Committee have approved a resolution the importance of writing clear-cut specifications, and the placing of the responsibility for the maintenance of temporary heat and air conditioning contractor's specifications.

The resolution was formulated by the sub-committee on temporary heating and cooling specifications: Eugene Bradshaw, United Association, Washington, D. C., chairman; Frank C. Lawton, Mechanical Contractors Association of America, Paterson, N. J.; Harvel W. Hottel, Refrigeration and Air Conditioning Contractors Association, Silver Spring, Md., secretary; and Irvin L. Rechkemmer, National Association of Plumbing Contractors, Canton, Ohio.

The resolution stated, "It would appear proper and fair to all concerned that the cost for temporary work be negotiated on a cost plus basis with the mechanical contractor performing the contract work on the job as required and as deemed necessary by the owner or the general contractor in order to meet the temperature requirements of other sub-contractors and thereby justify the additional expenditures depending on the urgency and the overall importance as related to all trades and the necessity of meeting certain performance time schedules."

You'll Want To Know

Predict Record High for New Building in Current Year

NEW CONSTRUCTION in 1959, outdistancing optimistic forecasts, is headed for a record total of $53 billion, the building magazine Architectural Forum said today.

The pace for the first four months of the year has been so fast that Forum has added another billion dollars to its boom prediction made in late 1958.

The strength of this building surge is concentrated in two major areas—private residential building (up 29 percent in the first four months) and public building (up 17 percent). Housing starts in the same period were the highest on record (422,200), and the seasonally adjusted rate was 4000 units higher than the previous four month peak of 1,362,000 in 1955.

Public construction, sparked by highway construction and military building, is 17 percent higher in the first four months of this year than in record-setting 1958. Highway building has risen 25 percent to $1.3 billion and military building, with increasing amounts going into new missile facilities, has gone up 34 percent.

Martin Named to ARI Engineering Staff

MARCEL R. MARTIN has joined the engineering department staff of the Air-Conditioning and Refrigeration Institute as assistant engineer, it was announced by Frederick J. Reed, chief engineer of ARI.

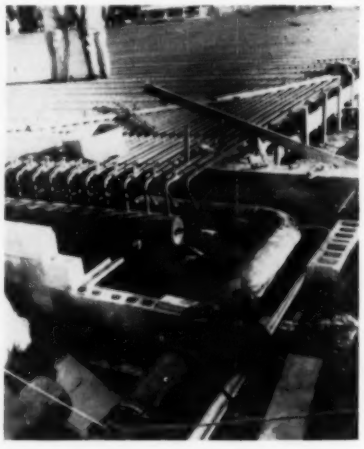
Mr. Martin will assist Mr. Reed in his work with the engineering and standards committees of ARI product-sections on standards, certification programs, and other technical matters, as well as other activities of the engineering department, such as the preparation of technical booklets and releases, liaison with technical societies and trade associations.

You'll Want To Know

36,000 ft of Piping Used in Hockey Rink for AHL Hershey Bears

IN THE CONSTRUCTION of the new outdoor ice skating rink for the American Hockey League's Bears in Hershey, Pa., 36,000 ft of 1 in. wrought iron pipe was used, according to A. M. Byers Co.

Construction details of the 75 × 140 ft rink included use of 6 in. of crushed stone, sealed with asphalt, topped with 2 in. of insulating material, and tar-mopped 15 lb felt. Steel "chairs" 1½ in. high were used to mount pipe holders carrying the 36,000 ft of 1 in. pipe before the concrete was poured.



The pipe was spaced on 3½ in. centers and embedded in 4 in. of concrete. All pipe joints were welded.

Calcium chloride brine is used to maintain the ice at 14 to 17 F.

Wide Work Range Sought for Electronic Computers

APPLICATION OF electronic computers to the widest possible range of work in science and industry will be one of the key subjects at the coming Instrument Society of America Conference and Exhibit to be held in Chicago, September 21-25, 1959.

Among the technical sessions likely to attract major attention will be those dealing with the question of using computers in control of industrial processes, since developments in this area rapidly are bringing many industries to the day of the automatic plant.

One of the 54 technical papers related to the subject of electronic computers is one entitled, "A New Approach to Control Valve Sizing," dealing with a new method by which, through the use of computers, previous errors in measuring valve sizes may be reduced by more than 25 percent.

ARI Report on Improved Equipment Given at Meeting

THE RECENTLY INITIATED American Petroleum Institute study aimed at improved oil burning equipment "has sparked a spirit of enthusiasm and cooperation within the oil industry," said C. M. Blickensderfer, Sinclair Refining Co. and chairman of API's fuel oil committee, in presenting an initial report on the study at the midyear meeting of the Institute's division of marketing.

The study is now under way at Battelle Memorial Institute, Columbus, Ohio. The objective of the project is to formulate an industry-wide research program to improve oil burner equipment and develop new uses for fuel oil.

D. W. Locklin of Battelle's mechanical engineering department is serving as full-time coordinator of the study and is acting as research consultant to the fuel oil committee. Battelle engineers are presently surveying recent and current research activities based upon visits to laboratories of oil companies, burner manufacturers, component manufacturers, and research organizations. In addition, the study will include an evaluation of new and unconventional concepts in fuel oil combustion.

You don't need a TALL CHIMNEY

BIG MILLS 640 BOILER

One of the many exclusive advantages of the new Mills 640 Boiler is its compatibility with modern architectural design. We refer to the marked trend to lower structures – with the resultant desire for lower, less obtrusive chimneys.

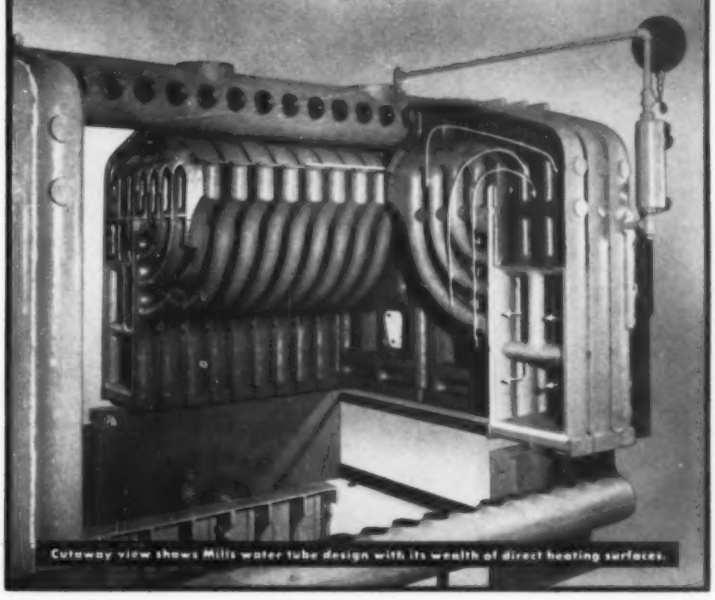
The Mills 640 is the obvious answer to this need. High efficiency and low stack temperatures are combined with extremely low draft loss. Result: the Mills 640 can be used – with *natural* draft – with lower chimneys than *any other boiler* of its size.

The table below shows the saving in chimney height which can be gained by using the 640 – with *natural* draft – against either a fire tube boiler or a cast iron boiler of other make.

BOILER OUTPUT	RECOMMENDED CHIMNEY HEIGHTS, FT.		
Sq. Ft. Steam Radiation	640 Mills	Cast Iron Boiler of other Make	Conventional Fire Tube Boiler
15000	55	85	65
20000	55	85	70
25000	55	95	70
30000	55	100	85

Write for the new bulletin which illustrates and describes the Mills 640 and gives complete engineering data. 640-4

The new Big Mills 640 Boiler as installed, covered with standard magnesia block.



Cutaway view shows Mills water tube design with its wealth of direct heating surfaces.

H.B. Smith CAST IRON BOILERS

THE H. B. SMITH COMPANY, INC., WESTFIELD, MASSACHUSETTS • *EST. 1853*

ANNOUNCING NEW **POWELL**

Handwheel Nut—securely holds malleable iron, non-heating handwheel to the stem.

Protruding Packing Gland—a Powell feature—compresses the packing, offers additional guidance to the stem, and prevents packing nut from becoming loose and rotating with stem.

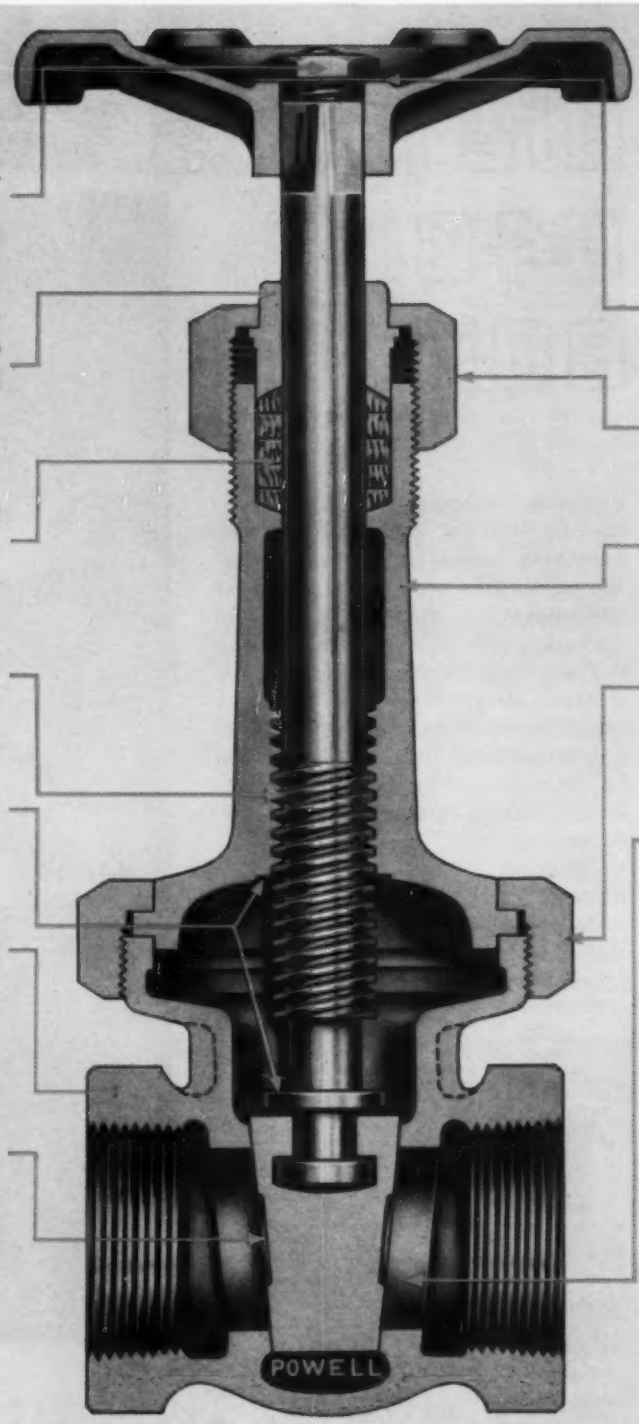
Deep Stuffing Box—holds more than ample amount of high-grade steam packing.

Stem—is high tensile bronze, extra heavy, of large diameter, with long Acme threaded section.

Repack-Under-Pressure Seat and Collar—permit valve to be repacked under pressure when fully open.

Body—a high tensile bronze casting, scientifically designed to provide full flow area through the valve.

Wedges—Interchangeable Solid or Double Wedges are available in rising stem valves. They are held to stem by a "T" slot, and are accurately guided to valve seats by means of integral cast lugs that travel in female guideways in the valve body. Entirely clearing the waterway, full unobstructed flow through is assured.



Sectional—Union Bonnet Rising Stem Gate Valve Fig. 2700—125 pounds, Fig. 2714—150 pounds.

POWELL...world's largest family of valves

BRONZE UNION BONNET GATE VALVES

for 125 and 150 pounds WSP

These new BRONZE Union Bonnet Gate Valves have many superior features—some of which are outlined here. For complete details, write for new illustrated circular. Or check with your nearest Powell Valve distributor.

Identification Plate—gives Figure Number and kind of valve.

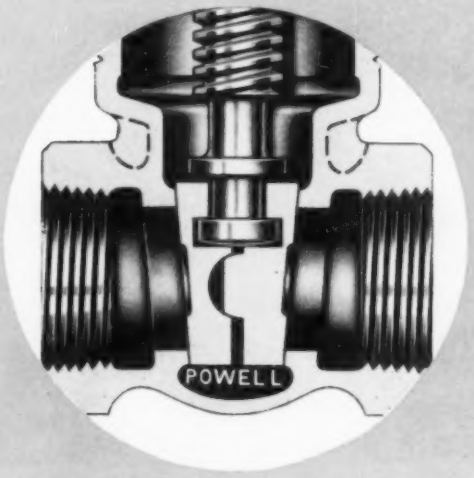
Heavy Hexagonal Packing Nut—for holding gland and adjusting packing.

Long Bonnet—cast of high tensile bronze for long service.

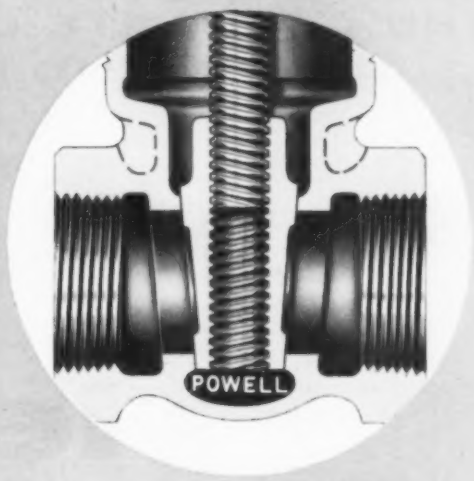
Octagonal Ring Nut—is deep threaded and tightly holds body-bonnet connection. Affords additional wrenching positions.

Ample Space—between seats and end of pipe thread prevents injury to seats when screwing pipe into the body.

Fig. 2707—125-pound Union Bonnet Non-Rising Stem Gate Valve. Also available for 150 pounds—Fig. 2712.

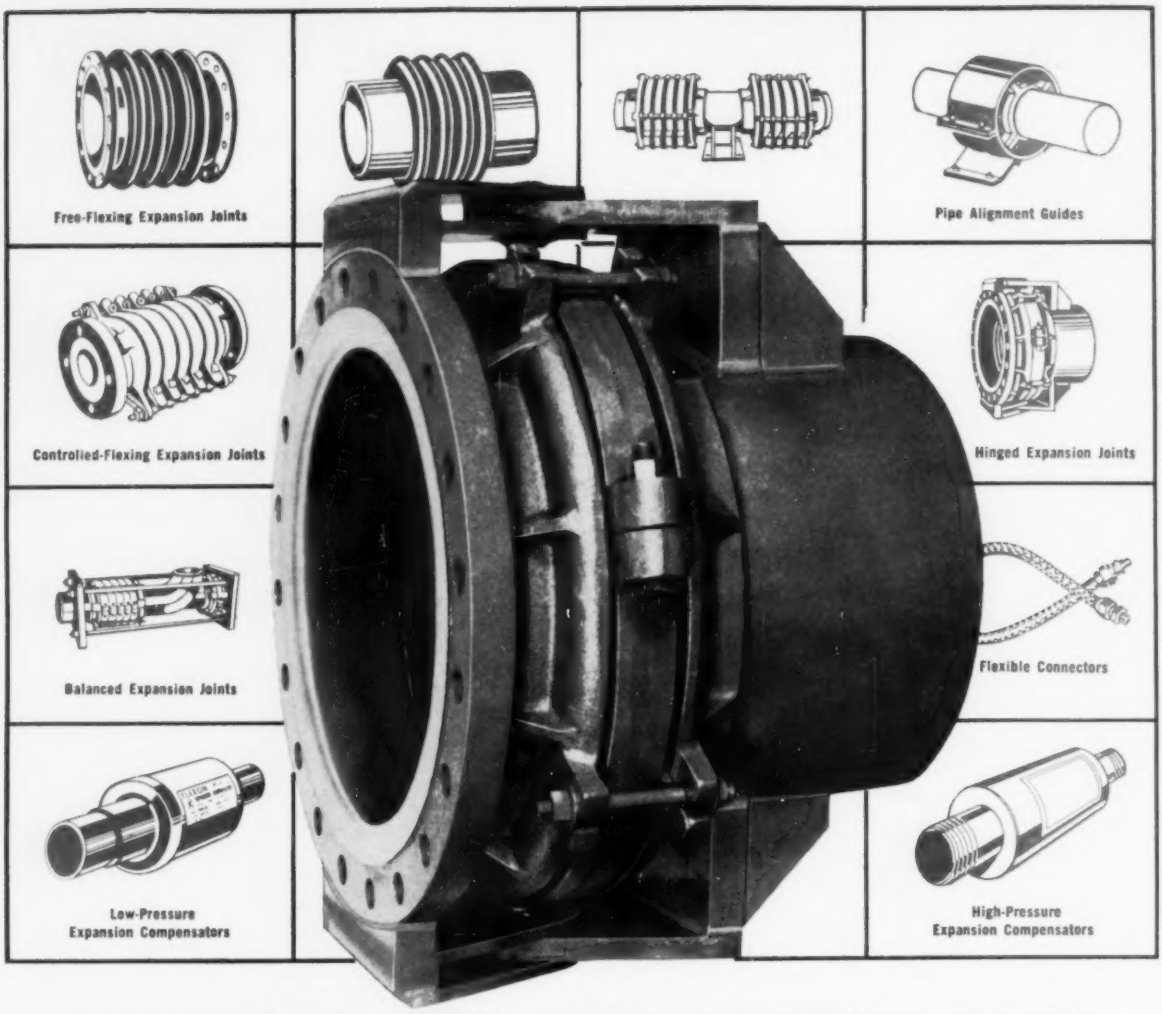


Detail of Sectional View Inside Screw Rising Stem Gate Valve showing Double Wedge Disc and Integral Seats.



Detail of Sectional View Non-Rising Stem Gate Valve showing Solid Wedge Disc that rises on stem. Integral Seats.

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**



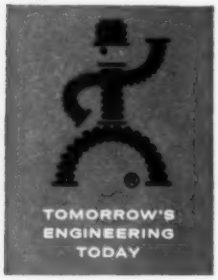
THE COMPLETE LINE TO TAKE CARE OF ANY KIND OF PIPE MOTION

For hinged or any other type of standard or special expansion joints – your best bet is FLEXONICS. Here's where you'll find the equipment, the experience, the skill to take care of any kind of pipe motion problem. Here's where you benefit from more research . . . more metallurgical care . . . more service . . . and now standard stock sizes for quick delivery from five FLEXONICS warehouses. They all add up to expansion joints that you can *install and forget* – plus expansion compensators, flexible connectors, the all-new FLEXONICS pipe alignment guides and other piping accessories.

Today—write for your copy of the Flexonics Expansion Joint Design Guide . . . 28 pages of valuable information.

Member Expansion Joint Manufacturers Association

EJ-240



Flexonics

EXPANSION JOINTS

FLEXONICS CORPORATION • 7391 SOUTH THIRD AVENUE • MAYWOOD, ILLINOIS

Divisions

INDUSTRIAL HOSE • EXPANSION JOINT • BELLOWS • AERONAUTICAL • AUTOMOTIVE

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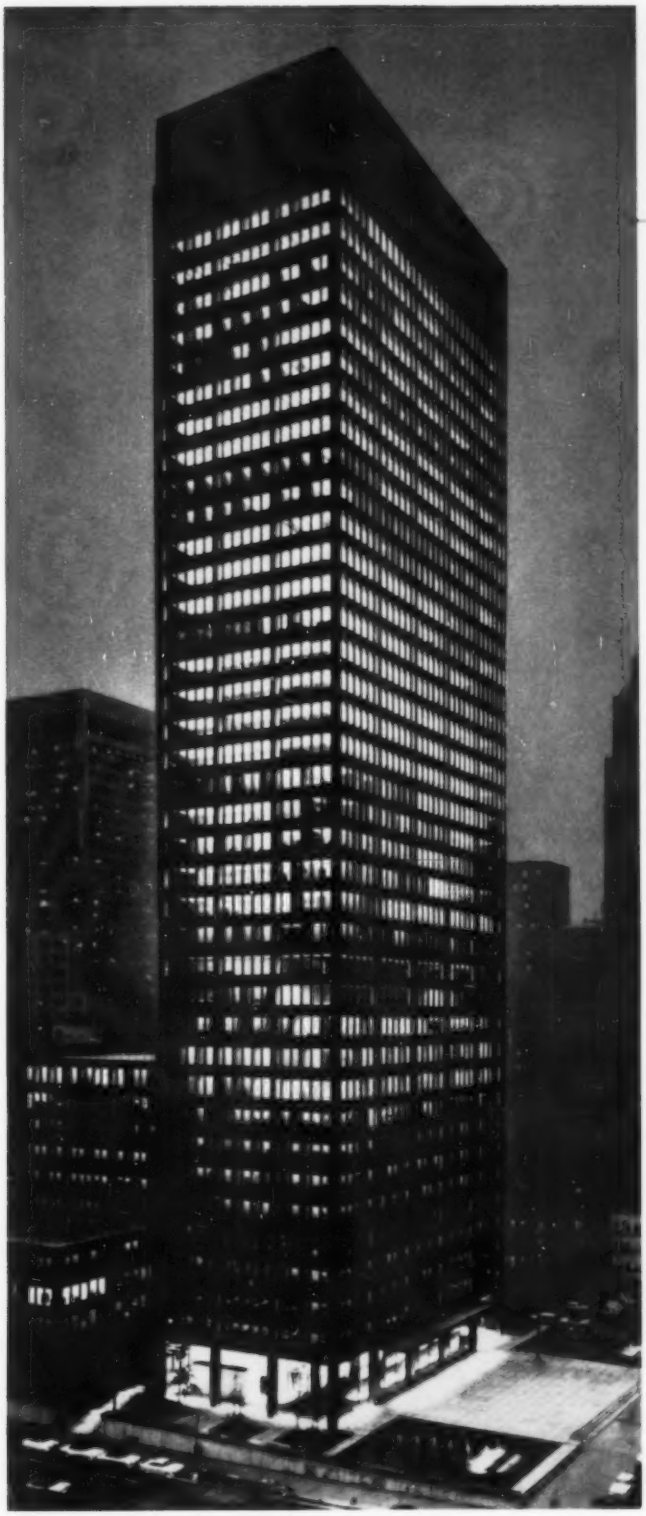


FROM THE GROUND UP . . .

World's First Bronze Skyscraper Uses Phelps Dodge Red Brass Pipe!

A vital network of Phelps Dodge Red Brass Pipe—roughly 17 miles of it—runs through the magnificent new bronze office building at 375 Park Avenue in New York. From street level to the top of this striking skyscraper, the maze of piping carries the hot and cold water needed for the 38-story structure's mammoth plumbing system.

A number of especially designed water fixtures, including a unique central drinking water system, are connected to these Phelps Dodge pipes. Other PD pipes under the park plaza supply water to the graceful fountains and pools in front of the building.

Plumbing contractors know that the famous Phelps Dodge "Mine-to-Market" quality line of copper tube and pipe more than meets every requirement for modern plumbing systems. That's why they specify Phelps Dodge for every kind of installation —from skyscrapers to homes!

Red brass pipe in pool bottoms on building plaza furnishes water for beautiful fountain displays.

Quality tube sold the quality way—through authorized wholesalers!

PHELPS DODGE COPPER PRODUCTS CORPORATION

New York, N. Y. • Los Angeles, Calif.

PD

You get these benefits when you install YARWAY GUN-PAKT EXPANSION JOINTS

Why do industrial plants, institutions, universities and central heating plants SPECIFY and INSTALL Yarway Gun-Pakt Expansion Joints?

Because with Yarway you get:

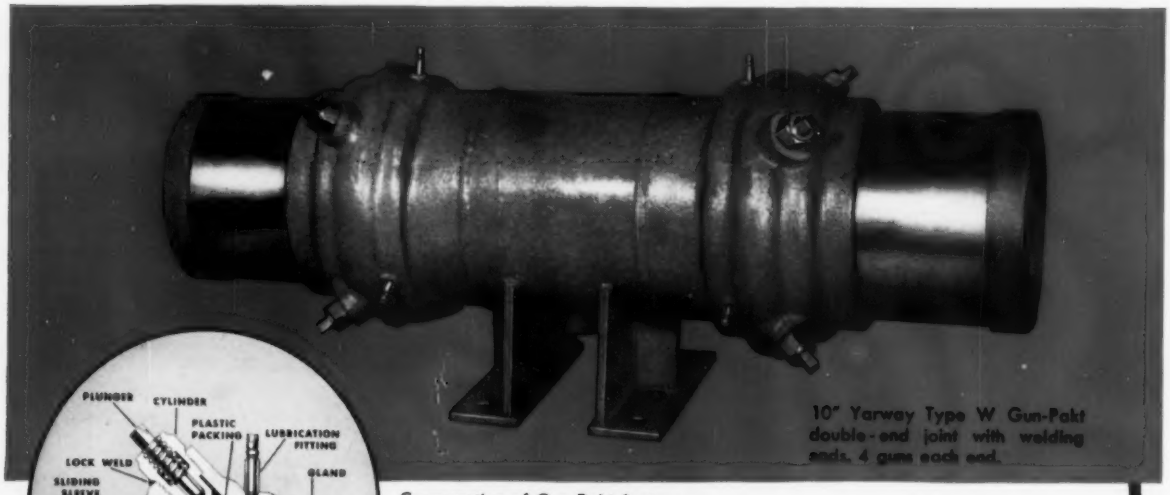
- **CONTINUOUS SERVICE**
  Costly shutdowns are eliminated. Packing is seldom necessary but may be added *under full line pressure.* No vents are necessary. Never needs repacking.
- **RUGGED DEPENDABILITY ALL STEEL CONSTRUCTION**
  Durable chromium plated seamless steel sleeves. No chance *of metal fatigue.* Wrought steel bases provide rugged, positive anchorage.
- **INTERNAL AND EXTERNAL GUIDES**
  Positive alignment of sleeve in stuffing box *—where it counts!*
- **LIGHT WEIGHT, STREAMLINED DESIGN**
  Requires less space to install—less space to maintain—smaller manholes.

Many Gun-Pakt joints have been *in service over 25 years with only nominal maintenance*—no major repairs or periodic overhauls. Maintenance costs are negligible—records show average to be one manhour and 65 cents worth of packing per joint per year. AND—NEVER A SHUTDOWN FOR REPACKING!

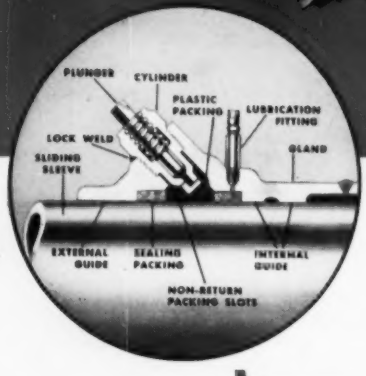
YARWAY field engineers are qualified to advise on installation and service—at no cost to you. Investigate today. Write for Bulletin EJ 1917 ('59).

FOR YOUR NEXT PIPELINE JOB—BE SAFE—BE SURE! SPECIFY YARWAY GUN-PAKT.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

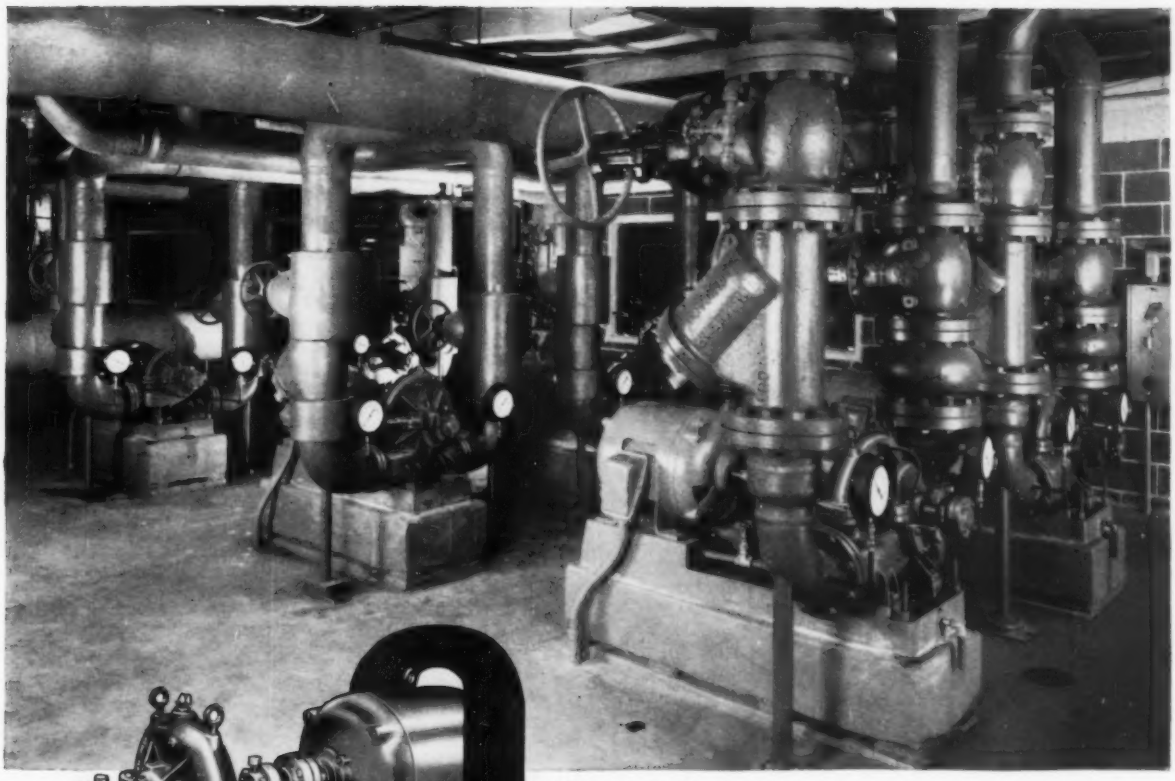


10" Yarway Type W Gun-Pakt double-end joint with welding ends, 4 guns each end.

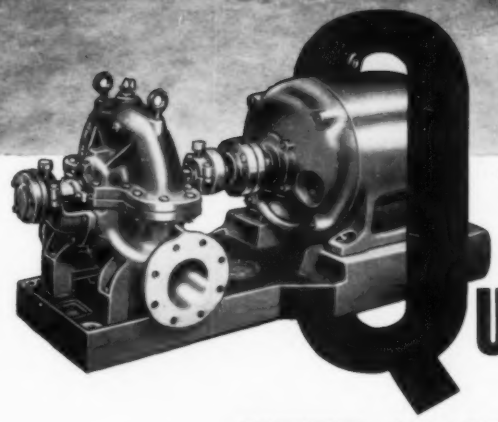


Cross-section of Gun-Pakt feature. To add packing, just insert a plug and turn the plunger. Note non-return packing slots.

YARWAY GUN-PAKT



"Buffalo" Double Suction Single Stage Pumps Used for Condenser Water and General Service.



QUALITY SYSTEMS

NEED QUALITY PUMPS "BUFFALO" WILL BACK UP YOUR SELECTION

In clear water installations where a long life of maintenance-free dependability is desirable, you can rely on "Buffalo" Double Suction Centrifugal Pumps. "Buffalo" gives you quality design and construction. The "Buffalo" features listed at right speak for themselves. "Buffalo" Pumps combine the finest hydraulic design and workmanship with the best materials obtainable.

EXTRA Savings with Low Parts Inventory:

Because of maximum parts interchangeability, users of "Buffalo" Pumps enjoy lower parts inventories. The result is savings in money and space. Another advantage is greatly simplified inventory control.

Whatever your needs in clear water service, investigate the advantages of "Buffalo" Double Suction Pumps. Capacities from 10 to 14,000 gpm. For complete facts, write for Bulletin 955-S. Or better yet, contact your nearby "Buffalo" engineering representative.

Long Life, Reliable Operation Features of "Buffalo" Pumps Include:

- **Casings** — Precision-machined with ample water passages. Horizontally-split for quick inspection.
- **Impellers** — Designed for highest efficiencies, consistent hydraulic balance.
- **Ball Bearings** — Heavy-duty type, supporting each end of sturdy, oversize shaft.
- **Bronze Wearing Rings** — Are easily renewable. Thus rings only and not casing need be replaced.

"Buffalo" Pumps bring you the "Q" Factor — the built-in QUALITY which provides trouble-free satisfaction and long life.

BUFFALO PUMPS

Division of Buffalo Forge Co.

171 MORTIMER ST. • BUFFALO, N. Y.

"Buffalo" PUMPS

Canada Pumps, Ltd., Kitchener, Ont. • Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Less than ¼ turn opens or closes

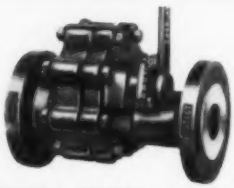
When you need...

- Quick action
- Leak-Proof Seal
- Minimum Pressure Drop
- Straight-through full flow
- Valves that cannot wedge or jam
- Self-grinding rotating disc

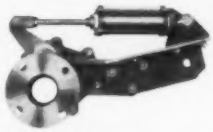
Specify Everlasting Valves

For more information **WRITE** for these bulletins.

BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.



GENERAL SERVICE
Where drop-tight seal and full flow is essential.



CYLINDER OPERATED
Can be remotely controlled, electrically or manually.

STEAM JACKETED
Assures free flow of viscous materials.

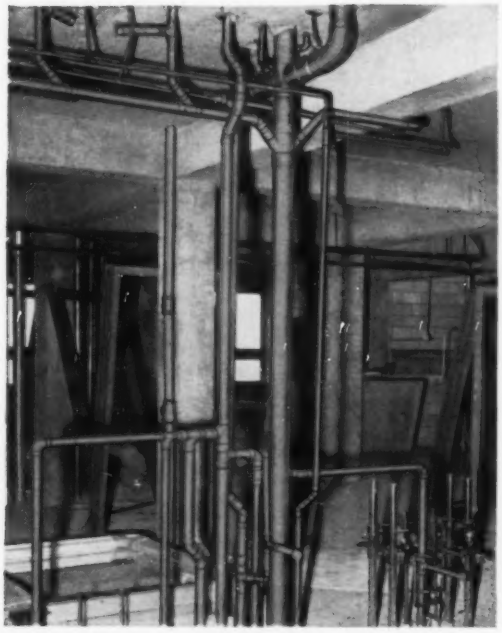
WEIGHT-OPERATED
For automatic drains or emergency shut off.

Everlasting VALVES

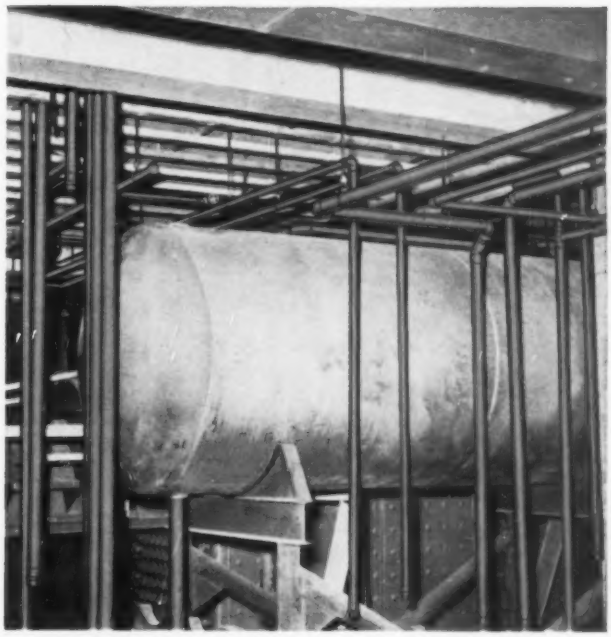
EVERLASTING VALVE CO., 61 FISK STREET, JERSEY CITY 5, N. J.

EV 406

ALL-COPPER plumbing chosen for new Butte hospital because it cost no more—saved space—offered economies in maintenance



WATER SUPPLY AND SANITARY DRAINAGE. Roughed-in piping system for rest rooms and therapy service shows how compact assemblies of copper tube and solder-joint fittings save valuable floor and overhead space. General Contractor was Dan J. Mooney, Butte, Mont.



HEATING SYSTEM: Copper tube piping for hot-water heating system, awaiting installation of boilers. Over 6 miles of Anaconda copper tube in sizes up to 6" and about 10,000 Anaconda wrought-copper and cast-brass solder-joint fittings for plumbing and heating system supplied through M & L Supply Co., Inc., plumbing wholesaler, Butte, Mont.

The $2,100,000 Silver Bow County Hospital, Butte, Montana, is the first major public building in the state to have all-copper plumbing–for sanitary drainage lines, water supply, and heating.

What the architect says: "In specifying materials to be used in a building, we feel it incumbent on the architect to select those materials that have longer life and contribute to low maintenance costs. For this reason, we selected copper tube for all plumbing lines in Silver Bow County Hospital. In a hospital there are many plumbing lines; they are all concealed; and the use of less durable materials would not give true economy in the operation of the building." Norman J. Hamill, Norman J. Hamill & Associates, A.I.A., Butte, Montana, and Idaho Falls, Idaho.

What the plumbing contractor says: "In a hospital, intricate systems are the rule rather than the exception and the use of copper in Silver Bow County Hospital made it possible to complete all lines with greater ease and speed than would have been possible with other materials. . . . Copper tube requires less space in partitions and other areas of concentrated services. Its use also made it possible to fabricate bends, connections, etc., at a workbench with the result that final installations were made in one operation with a minimum of effort. . . . Particularly in hard-to-get-at places overhead, copper's lighter weight than other materials was a factor that appealed to us." Floyd J. Stewart, Reardon Plumbing & Heating Co., Butte, Montana.

For more information on ALL-COPPER plumbing, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA®

COPPER TUBE AND FITTINGS

PRODUCTS OF THE AMERICAN BRASS COMPANY

Available through Plumbing Wholesalers

"Which of these major gas valve problems is yours?

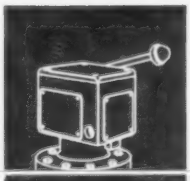
capacity?...safety?"

Compare these gas capacities

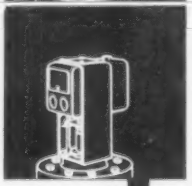
GAS CAPACITY — 1" DROP

PIPE SIZE (INCHES)	HI-FLO VALVE CU. FT. HR.	HI-FLO VALVE MAX. OPER. PRESS. P.S.I.	HI-FLO VALVE C_V FACTOR	CONVENTIONAL GLOBE VALVE CU. FT. HR.
1 SCR	2,000	50	37.8	920
1¼ SCR	2,700	50	51.0	1,370
1½ SCR	4,000	50	75.6	1,840
2 SCR	8,000	25	151.0	3,570
2½ SCR	12,900	15	244.0	4,500
3 SCR	17,000	15	320.0	6,600
4 FLG	27,000	8	510.0	8,900
6 FLG	54,000	5	1020.0	17,800

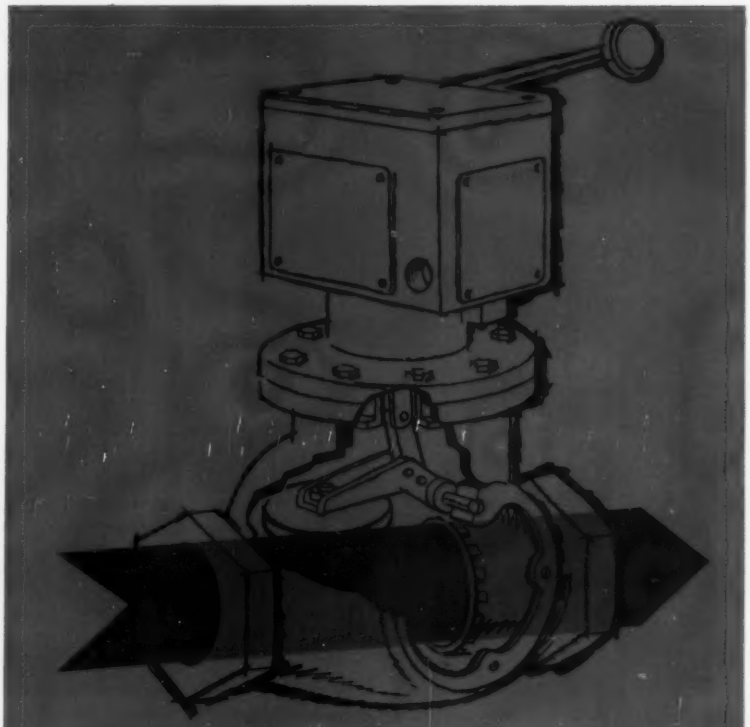
CHOICE OF TWO ACTUATORS:



V-116 MANUAL RESET, with lever action—90° handle travel. Held open electrically, spring closed on power interruption.



H-117 HYDRAMOTOR, electric reset, with either fixed opening speed or adjustable opening speed regulated to design of equipment.



"THIS NEW GENERAL CONTROLS HI-FLO GAS VALVE SOLVES BOTH... AND MORE

Straight through flow provides high capacity . . . minimum pressure drop. And you get an unequalled combination of safety characteristics. *Spring-loaded* inner valve closes with pressure for positive safety shut-off. Direct in-line action without complicated linkage. *Rubber-faced* vertical seating won't scratch or score . . . assures *tight shut-off. Dual release actuator* assures positive closing. Fixed or adjustable opening speeds for specific duty. Line sizes from 1" to 6" pipe. Costs less than valves that can't measure up in quality, performance or adaptability. Check the capacity table . . . then check the valve out with your nearest General Controls representative."

GENERAL CONTROLS

America's Finest Automatic Controls for Home, Industry and the Military

Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Six Plants—42 factory branch offices serving the United States and Canada

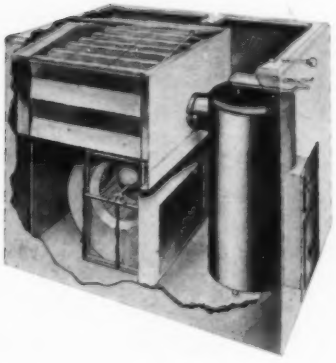
Campbell

WARM AIR HEATERS FOR LARGE BUILDINGS

Our Savior Lutheran Church, Des Moines, Iowa, heated with a Campbell H-700 gas-fired heater. Architect, George A. Spooner, Des Moines. Heating contractor, Corn States Metal Fabricators, Des Moines.

THE ANSWER FOR CHURCH HEATING

You'll discover many advantages in specifying Campbell Warm Air Heating for churches. They are low in cost, easy to install, operate very quietly, and deliver abundant heat with amazing fuel economy. Your customers will be especially pleased with the fast heat delivery which is an absolute necessity in churches and other public buildings. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs. Let our engineers help you on your next large heating job.



MANUFACTURERS' AGENTS

We have some very attractive openings for men calling on heating contractors and architects.

CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

NOW... Split-Second Handling

With the New Type 75 HENRY MULTIPLE CARTRIDGE DRIERS

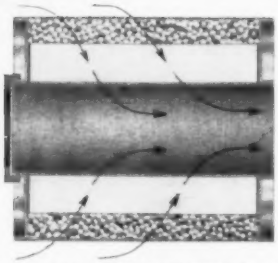
An efficient and high capacity multiple cartridge filter-drier with a drying and flow capacity range up to 125 tons.

Low Pressure Drop...No By-Pass Required

875-CMS DRI-COR® Filter-Drier Cartridges for these new driers are self-sealing and self-positioning. It requires only a few seconds to insert the cartridges into the drier shell, resulting in a minimum of exposure to the atmosphere and loss of cartridge drying capacity. Thus, the cartridges are clean, dry and complete—due to efficient design and split second handling.

The refrigerant flows uniformly over the total cartridge surface, through the desiccant bed and each filter core. This results in maximum moisture and acid removal with high flow capacity and low pressure drop.

These brass driers contain from two to five cartridges and are available with connection sizes ranging from 1⅛" to 2⅛" O.D. Solder.



CAT. No. 875-CMS DRI-COR® FILTER-DRIER CARTRIDGE WITH

1. OUTER PERFORATED BRASS SHELL.
2. BED OF GRANULAR MOLECULAR SIEVES.
3. CERAMIC FIRED DESICCANT FILTER CORE.
4. INNER DUTCH WEAVE MONEL SHELL.
5. PROGRESSIVE FILTRATION.
6. ONE SIZE CARTRIDGE FOR ALL TYPE 75 DRIER SHELLS.

HENRY VALVE CO.

MELROSE PARK, ILLINOIS (Chicago Suburb)

Cable: Hevalco, Melrose Park, Illinois

VALVES, DRIERS, STRAINERS AND ACCESSORIES FOR REFRIGERATION, AIR CONDITIONING AND INDUSTRIAL APPLICATIONS

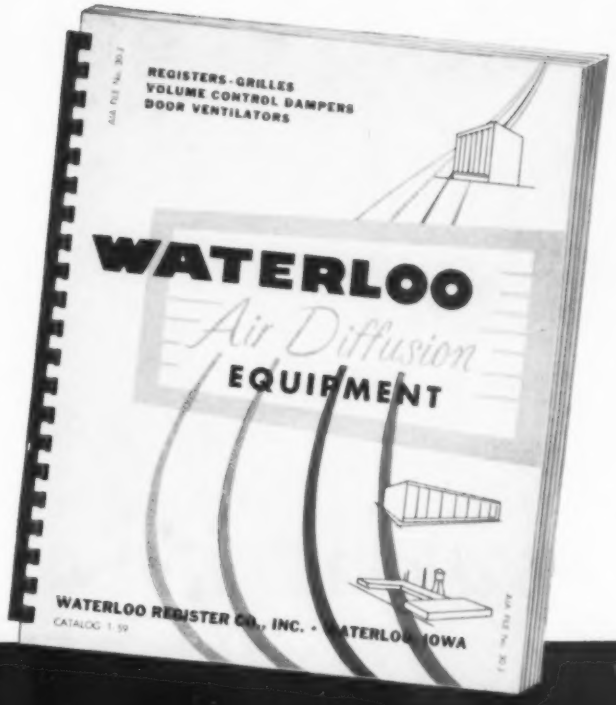
HENRY VALVE CO. CONTROLLING FLOW SINCE 1924

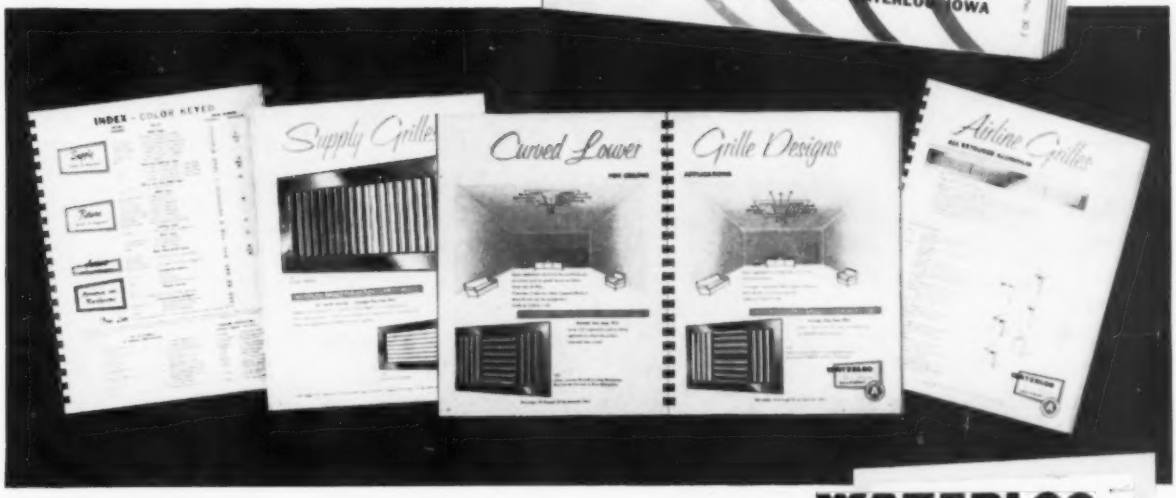
Announcing

NEW WATERLOO Catalog*

- Fully illustrated
- Color keyed for easy reference
- Contains complete data on wide range line of grilles and registers

This new 58-page Catalog gives you information you need on Waterloo's complete line of return and supply registers, extruded aluminum Airline grilles, removable core grilles, volume control dampers and door ventilators. Each type of unit is well illustrated and keyed in color for quick reference. The catalog contains many recent design developments.





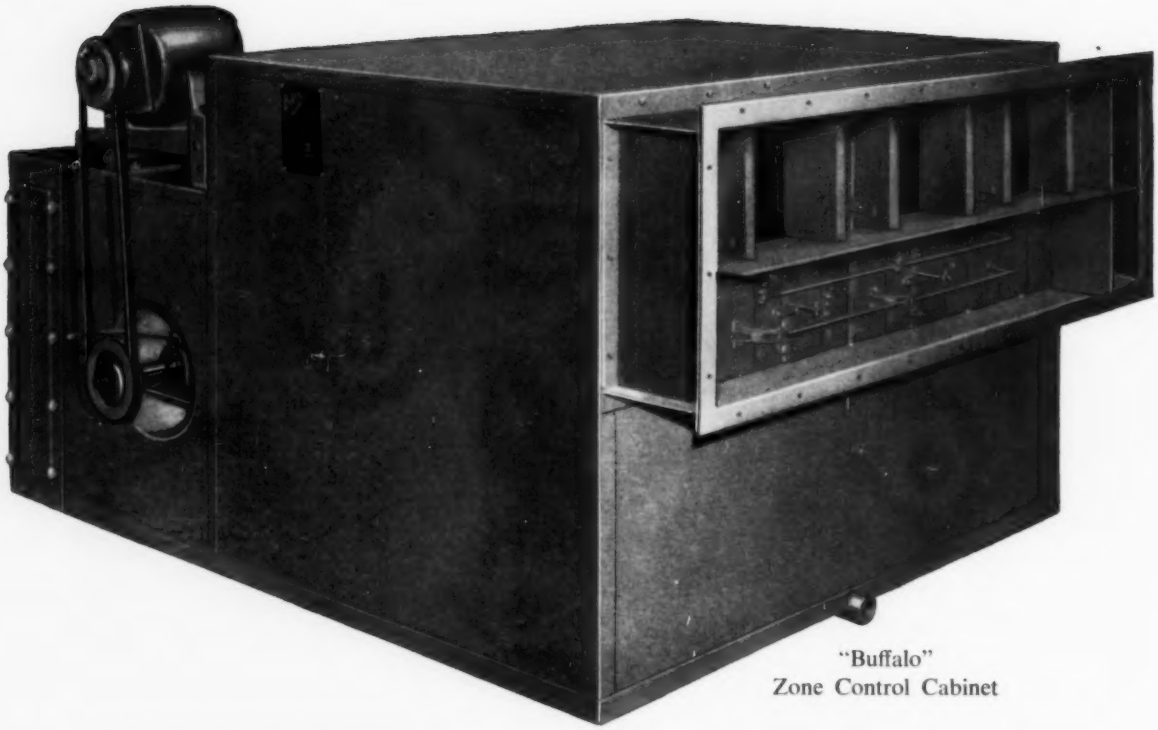
* *Write for your free copy of this comprehensive guide to the quality-built Waterloo line.*

WATERLOO REGISTER COMPANY, INC.

P.O. BOX 72, WATERLOO, IOWA

WATERLOO Air Diffusion EQUIPMENT

WR-113



"Buffalo"
Zone Control Cabinet

INDIVIDUAL ZONE CLIMATE CONTROL WITH THIS *ONE*

VERSATILE CENTRAL CONDITIONING UNIT

This quiet operating unit provides each of many zones with the exact combination of air conditioning required, from a single, central source. Temperature is controlled by mixing cooled and heated air in the correct proportions to suit each conditioned space.

The need for separate re-heat coils and their controls is completely eliminated. Sectionalized design facilitates handling and installation. The entire unit is ruggedly constructed for a long life of maintenance-free operation.

Investigate the many advantages of "Buffalo" Zone Control Cabinets. Phone your "Buffalo" engineering representative, or write for Bulletin AC-220.

"Buffalo" products bring you the extra "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

"Buffalo"

BUFFALO FORGE

Buffalo Pumps Division, Buffalo, N. Y.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT

ENGINEERING FEATURES OF "BUFFALO" ZONE CONTROL CABINETS:

FAN SECTION — Fans are all aluminum for weight-saving, corrosion and spark resistance. Mixed flow wheels provide fully stable, highly efficient operation. Steep pressure characteristic minimizes variation in capacity and power. Streamlined housings are designed for low air velocities. Oversize hollow shafts are perfectly balanced and allow ample safety margin. Bearings are self-aligning, grease lubricated, ball type — externally mounted for convenient maintenance.

COIL SECTION — Unique design with coils mounted at an angle permits maximum coil face area with minimum headroom and length. One piece pan is all-welded heavy gauge sheet, with rigid structural frame covered on inside with corrosion-resistant insulating compound.

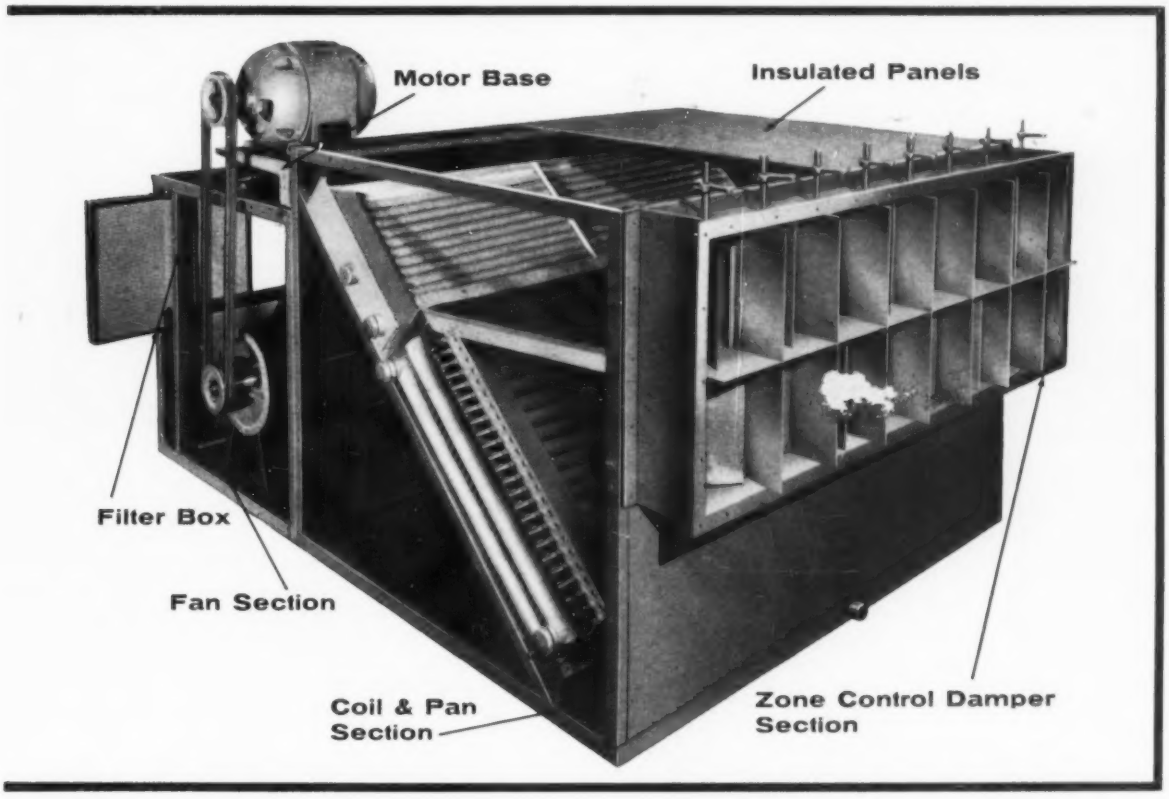
ZONE DAMPERS — Easily-removable, heavy gauge, all-welded frame and divider sheets. Blades are die-formed for stiffness and tight fit. Each zone has blade stops and extended shaft for damper control. Optional horizontal or vertical up-discharge permits minimum space without need for expensive discharge elbow.

FILTER BOX — Space-saving filter box is built into the fan section. Filters are easily replaceable.

MOTOR BASE — Completely adjustable for proper belt tension and different motor frame sizes.

INSULATED PANELS — Heavy sheet steel panels are insulated with ½" fiber glass.

ACCESSORIES — Filter boxes — either parallel type for low velocity cells, or flat type for high velocity cells. Mixing box either standard or combination style. Face dampers, or face and by-pass type. Humidifiers are steam grid or spray type. Resistance plate is either fixed or variable.

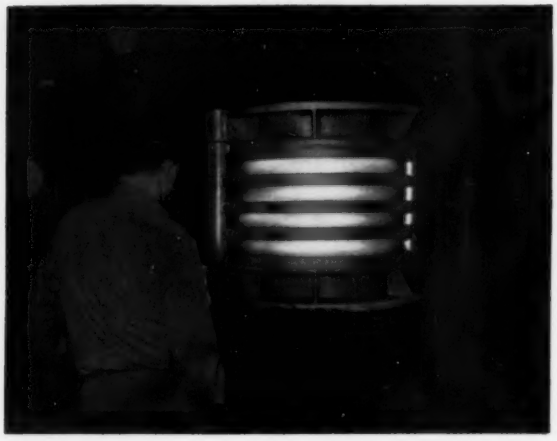


COMPANY, BUFFALO, NEW YORK

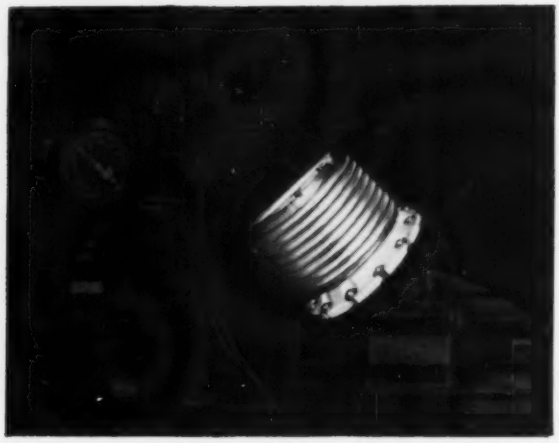
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

4 WAYS to get maximum reliability in expansion joints



1 Insist that the corrugated bellows be hydraulically formed. The reason is simple. Whenever bellows are formed by circumferential welding . . . whether by edge, seam or fillet welding . . they will always be subject to premature failure because of stress concentrations at the welds.



2 Be sure the manufacturer maintains a continuous and comprehensive program of endurance testing. This is basic, because of the many variables that affect expansion joint life. Accurate determination of expansion joint life expectancy can only be determined by cycling to destruction.

3 Demand proof that the manufacturer can produce longitudinal welds in the corrugated bellows having the same strength, physical properties and thickness as the parent metal . . . without grinding. A weld that is hard to find is a ground weld. Variations in weld thickness set up points of stress concentration . . . opening the way for premature failure.

4 Check the ability of the manufacturer to supply a team of *competent* design and application specialists to work with your engineers. Check their specific experience in handling critical, complex applications in your field . . . complete to the record of successes or failures behind them, and details of how this experience will be brought to bear on your problem.

At Zallea, none of the many factors affecting expansion joint reliability are left to guesswork . . . including the four vital ones above.

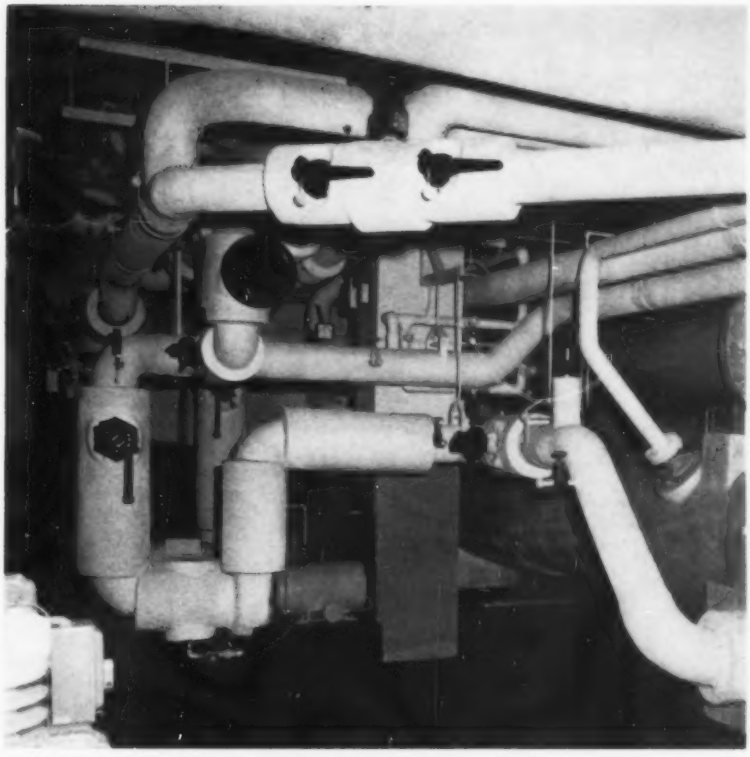
This is reflected in these facts. Zallea material specifications are the most exacting in the industry. Zallea expansion joints are hydraulically formed. Zallea advanced welding techniques insure welds having the same thickness, strength and physical properties as the parent metal. Zallea has done more cyclic testing to destruction than all government agencies and industrial firms combined. Zallea has produced more expansion joints than any other manufacturer . . . offers more application engineering experience.

For all the facts, write for Catalog 56. Zallea Brothers, Taylor and Locust Streets, Wilmington 99, Delaware.

Zallea for maximum reliability

ZALLEA BROTHERS, Wilmington 99, Delaware • World's largest manufacturer of expansion joints

DeZURIK ..the BEST valve for air conditioning because.....



IT NEEDS NO MAINTENANCE!

DeZurik Valves shut tight and open easily WITHOUT LUBRICATION! Their exclusive Eccentric Action eliminates the need for greases and guns, guarantees top performance — and longer life — on chilled water lines.

The rotary stem packing on a DeZurik Valve is kept under constant spring tension. It needs no adjustment, can't leak and cause costly water damage!

The absence of metal-to-metal seating eliminates the possibility of scoring and the necessity of reseating the valve.

The photo above shows a part of the installation in the Esso Standard Oil Office Building at Towson, Md., (Consulting Engineer, James Posey; Mechanical Contractor, C. George Mills & Sons, Inc.; General Contractor, Mullan Contracting Co., all of Baltimore). The Mechanical Contractor, C. George Mills & Sons, Inc., received a Craftsmanship Award for mechanical excellence on this installation given by the Building Congress and Exchange of Baltimore.

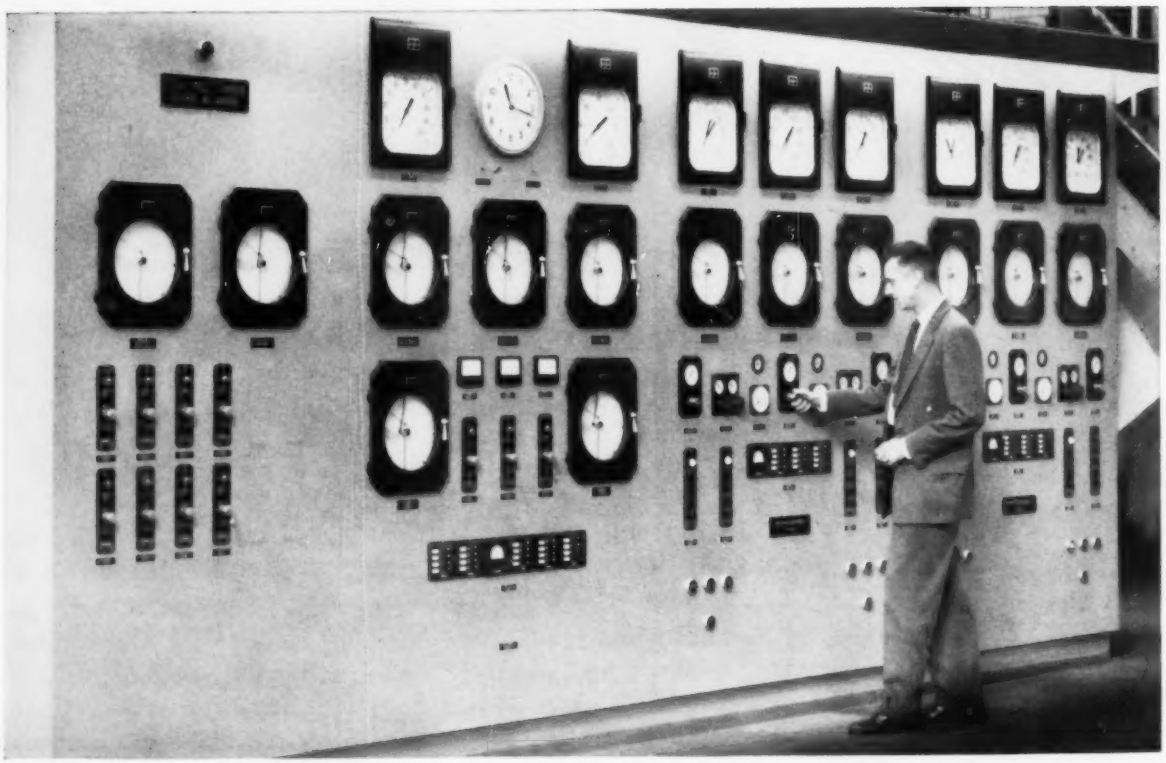
In 2-way, 3-way or 4-way models with manual, on-off or positioning actuators. For more details, see the DeZurik representative near you or write Dept. AC.

DeZURIK CORPORATION
SARTELL, MINNESOTA

Only DeZurik Valves give you all these advantages:

1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

CAPITOL HILL RECORDS COOLING



Central Supervisory Panel for Capitol Power Plant cooling system, Washington, D. C. Variables recorded by Taylor instruments include: Condenser Water Temperature and Flow; Outdoor Temperature and Humidity; Tons of Refrigeration; Chilled Water Flow in both East and West Tunnels; and Chilled Water Temperature and Pressure.

The Taylor Multiplying Linkage System multiplies temperature differential and flow to give tons of refrigeration, enabling the operator to evaluate the performance of the entire cooling plant from this master panel.

Taylor Instruments

EFFICIENCY WITH TAYLOR INSTRUMENTS

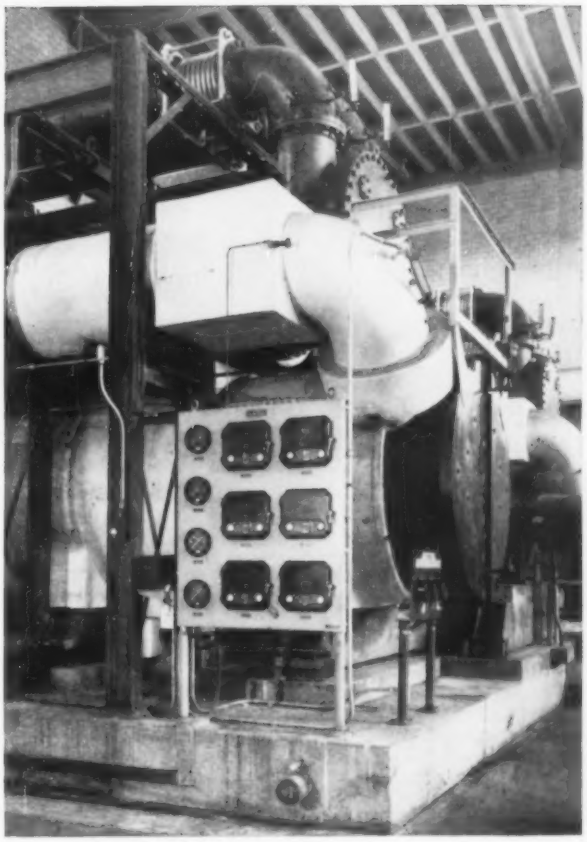
TAYLOR instruments at the Capitol Power Plant perform two important functions. They indicate and/or record the BTU performance of the cooling system on a central supervisory panel, thus enabling the operator to run the plant at maximum efficiency.

The new Capitol System has been in operation for over a year now, and the Power Plant Supervisor reports complete satisfaction with the performance of the equipment and the instrumentation. The new installation uses four York centrifugal compressors to provide 8800 tons of refrigeration to seven large government buildings. This is piped via a two-mile underground tunnel containing about 600,000 gallons of 40°F. chilled water which is circulated at a rate of 26,400 gpm.

Under the prime contract of Standard Engineering of Washington, D. C., Inc., the instrumentation was installed by Johnson Service Co., to plans drawn up by Consulting Engineer Guy B. Panero.

When you need air conditioning for human comfort or industrial processing requirements, there is a Taylor system that will ensure years of dependable, trouble-free performance. See your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

For Vision . . . Ingenuity . . . Dependability in solving your process control problems.



One of the four Compressor Transmitter panels at the Capitol Power Plant. Taylor Potentiometer Transmitters are used to obtain differential chilled water temperatures. Temperature and flow readings are transmitted to the Master Panel (*shown at left*) by TRANSVERTER* Transmitters. These transmitters have a wide range—from 10% to 100% of flow —and measure with an accuracy of ±1% of flow.

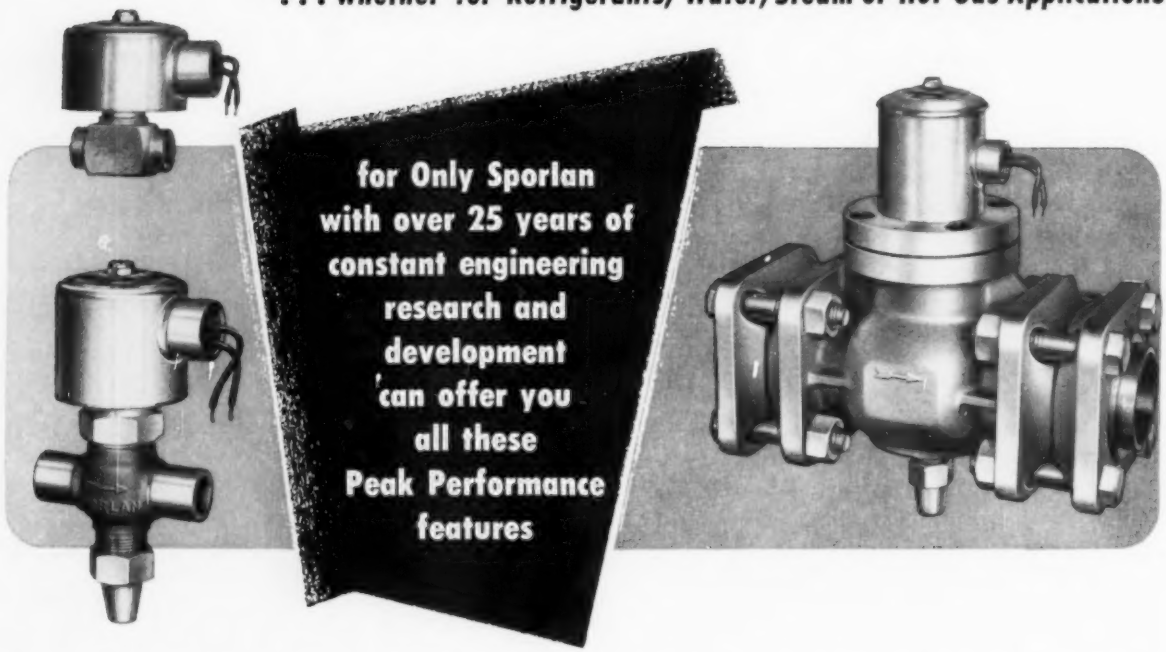
*Trade-Mark

MEAN ACCURACY FIRST

. . . don't accept anything less than

SPORLAN Peak Performance SOLENOID VALVES for any Installation . . . regardless of capacity

. . . whether for Refrigerants, Water, Steam or Hot Gas Applications



Sturdy take apart construction, few parts, all precision machined to assure positive closing.

All large capacity pilot piston operated Sporlan solenoid valves are equally applicable to Refrigerants 12, 22, and 500.

Sweat type connection valves assembled hand tight, saves valuable time in removing internal parts before installation.

Sporlan introduced synthetic seating over ten years ago to eliminate the possibility of seat leaks.

The famous Sporlan Blue Seal Coils with their high MOPD ratings permit the use of most valves for either Refrigerant 12 or 22.

Just three sizes of Blue Seal Coils fit the complete line of Sporlan solenoid valves.

Color coded lead wires allow quick and easy identification of coil voltage.

See your Sporlan Wholesaler today for complete information and be sure to ask him for Bulletin 30-10

. . . then you'll know why Sporlan Peak Performance means so much on any solenoid valve installation.

Our 25th Anniversary . . . 1934-1959

Have him explain Right Down the Line Sporlan Peak Performance too!

SPORLAN VALVE COMPANY

7525 SUSSEX AVE. ST. LOUIS 17, MO.

EXPORT DEPT. 85 BROAD ST. NEW YORK 4, N.Y.

CARRIER AGAIN MAKES HEADLINES WITH A

NEW ROOF-TOP COMMERCIAL WEATHERMAKER

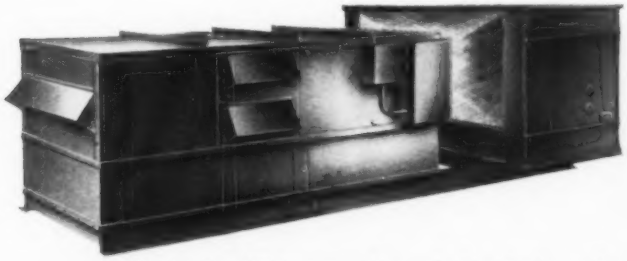
Puts both heating and cooling outdoors. Occupies no valuable floor space. Uses only a minimum of ductwork. Permits uncluttered ceilings. Saves hours of design time.

Here's the latest advance in heating and cooling for one-story buildings—the new Carrier 48B Air-Cooled Weathermaker*. Designed for roof-top installation, it provides your clients with the benefits of year-round air conditioning without the cost of extensive ductwork, without cluttering up ceilings and without tying up one inch of floor space. What's more, its simplified construction saves you hours of design time!

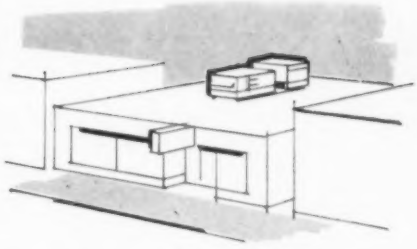
This versatile unit consists of a gas-fired heating section, a fan section and an air-cooled refrigeration section for cooling—all enclosed in a weatherproof casing and mounted on rails. Two capacities fit most heating and cooling requirements—7.5 and 10 tons for cooling; 200,000 and 250,000 Btus for heating.

The unit is factory charged, and refrigerant piping is installed. The compressor is protected by a five-year warranty. For more information call your Carrier dealer, listed in the Yellow Pages. Or write Carrier Corporation. Syracuse 1, New York.

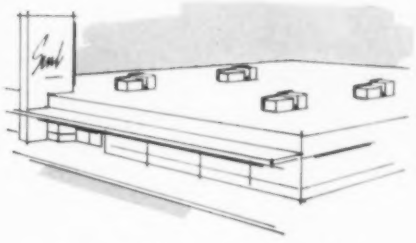
*Reg. U.S. Pat. Off.



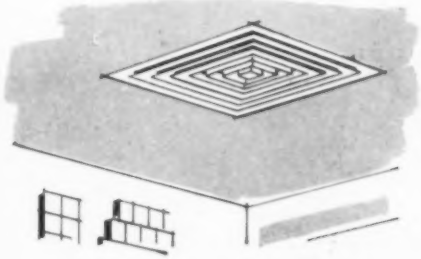
Basically the 48B is a one-piece unit, but rigging and handling are simplified by shipping the unit in two sections (base unit and fan section). It also installs with a single supply and return air duct, so only one duct passage must be cut through the roof. Installation is further simplified with only a single electrical power connection.



A single unit will both heat and cool a small store or plant



Larger buildings require two or more units to heat and cool



One supply and return air grille fits flush to ceiling

MORE PROOF OF
BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE
Carrier

TO KEEP MAINTENANCE COSTS DOWN . . .

New $6,000,000 Hospital Selects LUNKENHEIMER VALVES

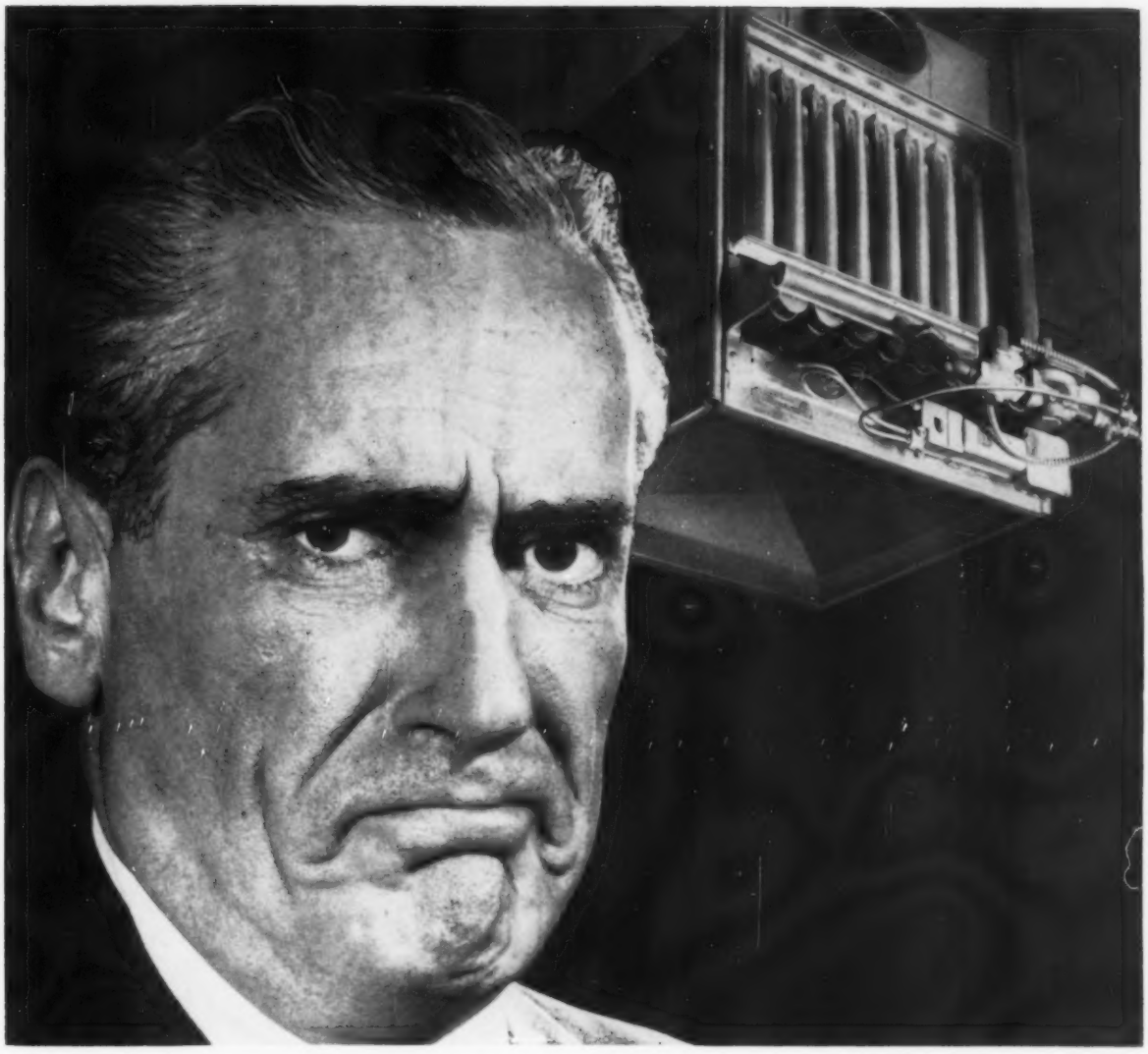
Thanks to sound planning, valve maintenance expenses in this new Hospital will be kept to a minimum. Lunkenheimer Solder End Valves were installed because, part-for-part, they provide longer maintenance-free performance than any other valves designed for similar service. They have established unmatched performance records on steam, hot and cold water lines, heating and air conditioning systems, as well as oil and gas lines, in commercial, industrial and institutional buildings all over the world. Why put less than the best in specifications, when the best costs no more? For specific recommendations on maintenance-saving Lunkenheimer Valves for new projects or for manufactured equipment . . . write The Lunkenheimer Company, Cincinnati 14, Ohio.

This impressive $6,000,000 structure will house the new Methodist Hospital, located just west of Minneapolis, in St. Louis Park. It will provide over 276 beds and 60 bassinets for the surrounding community, and a four-floor nurses' residence for over 135 student nurses and other personnel.

Hospital Administrator: Vernon T. Spry
Chairman of Building Committee: Clifford G. Retherford
Architects and Engineers: Ellerbe and Company
General Contractor: Kraus-Anderson, Inc.
Plumbing Superintendent: Douglas Erickson for Bolden Porter Company

LUNKENHEIMER QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES



TOUGH BUYERS

DEMAND REZNOR STAINLESS STEEL DUCT FURNACES

BECAUSE THE HEAT EXCHANGER AND BURNERS CANNOT CORRODE!

The plumbing, heating or air conditioning contractor has to be a tough buyer. He has to look ahead and consider possible trouble makers like corrosion in air conditioning, make-up or ventilation air systems. That's why so many contractors demand Reznor *stainless steel* duct furnaces: they *can't* corrode!

LOWER FUEL COSTS, TOO —The tough buyer wants to make sure his customers get even heat and lower fuel costs. That's why he appreciates Reznor "extras," like the gas modulating valve. As discharge temperatures rise, the valve cuts gas input to 20% of rated capacity, then shuts off the supply completely.

CHECK THE "TOUGH BUYERS' LINE" You can order and install Reznor duct furnaces in capacities up to 300,000 Btu. Use them in multiples for greater heat requirements. Buy matching Reznor blowers.

For the full story, phone your local Reznor distributor, or write to Reznor Manufacturing Company, Dept. 51B, Mercer, Pennsylvania.

THE HEATING WORLD IS FULL OF TOUGH BUYERS; THAT'S WHY REZNOR IS THE WORLD'S LARGEST SELLING DIRECT-FIRED HEATER!

REZNOR HEATERS

"THE TOUGH BUYERS' LINE"

O-B VALVES

New O-B regrinding swing check valves
ONCE IN...THEY STAY IN

When the job calls for bronze regrinding swing checks, the contractor who knows quality buys O-B valves. Why? Because, in addition to being easy to install, O-B valves have those extra features that please and attract customers.

For example, notice how easily the hanger pin and disc assembly can be removed from this O-B valve even when it is mounted close to a wall. Because the O-B Regrinding Swing Check valve has two side plugs, the hanger pin is always accessible no matter how the valve is mounted. This is not true for valves having only one side plug.

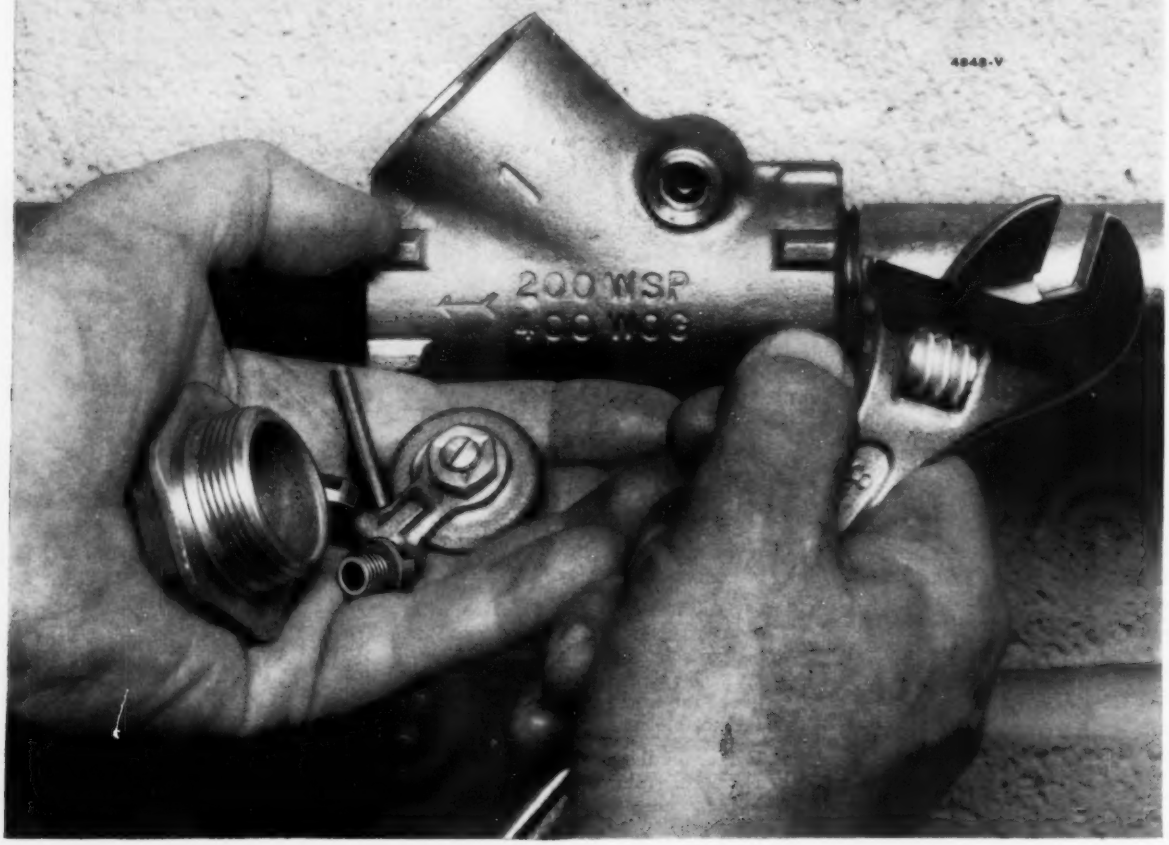
Normally, customers need not replace this valve when the seat and disc become worn. Seating surfaces can be reground without removing the valve from the line.

O-B Regrinding Swing Checks are available in sizes from ¼ through 3 inches for 150 lbs. WSP—300 lbs. WOG, and 200 lbs. WSP—400 lbs. WOG.

Ask your Ohio Brass distributor about the broad line of O-B Check, Gate, Globe and Angle bronze valves. Your customers will appreciate them... and appreciate you for installing them.

OHIO BRASS COMPANY
380 North Main Street, Mansfield, Ohio

4848-V



At Lambert Engineering Company
ST. LOUIS, MISSOURI

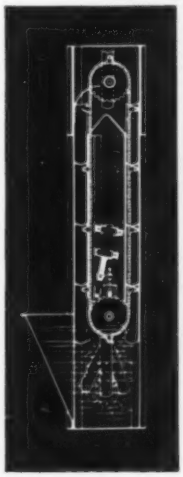
AUTOMAZE CLEANS AIR FOR 22 MONTHS ...AND NO SERVICE NEEDED

Since starting up early in 1957, this Automaze air filter has been operating continuously in the ventilating system of Lambert Engineering Company, St. Louis, Missouri. It has been efficiently cleaning 22,250 cubic feet of air per minute.

During this time, no attention of any kind has been required, virtually eliminating maintenance time and cost.

This is why: The Automaze is a revolving curtain panel filter that *cleans itself automatically* in a bath of oil. Airborne dirt impinged on the face of the filter panels is thoroughly cleaned as the panel passes through the oil reservoir. At the same time, adhesive is renewed automatically, assuring continuous, efficient operation.

Your Air-Maze representative will gladly discuss the operating economies of the Automaze for your air filtering requirements. Write, The Air-Maze Corporation, Dept. HP-7, Cleveland 28, Ohio.



Automaze continuous curtain panel filter at Lambert Engineering Company. Shows oil reservoir where panels are cleaned and adhesive renewed automatically. Operates by air or electricity.

Architect: S. G. Schmidt, St. Louis, Mo.
Contractor: Eichler Company, St. Louis, Mo.

AIR-MAZE
The Filter Engineers

AIR FILTERS • SPARK ARRESTERS • LIQUID FILTERS • SILENCERS • OIL SEPARATORS • GREASE FILTERS

For classrooms, offices, storerooms and other small locations

CARRIER ANNOUNCES A NEW 30,000 BTU/HR GAS-FIRED UNIT HEATER

With the new Carrier 46T30, you provide an economical and efficient answer to heating small area locations. This compact new 30,000 Btu/hr unit gives you these important features . . .

New Built-in Controls. Carrier supplies all the controls assembled on the unit.

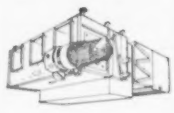
Summer-Winter Switch. Pull-chain switch for fan-only operation during the summer.

Low Voltage. Thermostat wiring is much easier.

The 46T30 has the quality features of all Carrier Unit Heaters. For complete specifications on the Carrier 46T30, get in touch with your Carrier wholesaler. You'll find his number is listed in the Yellow Pages under "Heaters—Unit." Or you can write direct to Carrier Corporation, Syracuse 1, New York.

Carrier offers every type of equipment for any commercial or industrial job

Heat Diffusers – Direct Fired for all types of fuel


Heat Diffusers for steam and hot water

Unit Heaters for steam and hot water

Gas Unit Heaters and Duct Furnaces

Carrier

AIR CONDITIONING
REFRIGERATION
HEATING
VENTILATING

. . . "Frictionless" design gives Flexotrol* longest life, stability and accuracy of any displacement level controller

By avoiding knife edges, bearings and associated pressure-tight mechanical fittings, K & M has achieved almost frictionless operation in the *Flexotrol* Displacement-Type Liquid Level Controller. As a result, errors due to friction, distortion and hysteresis are practically nil.

Actuation is accomplished through a torque element which directly transfers displacer movement to the controller. There are no intermediate levers. Because the rotation of the tube is limited (4°) and because the whole assembly is constructed of high-durability materials, the torque system has remarkable fatigue resistance. Tests in excess of five million operating cycles have produced no detrimental fatigue effect.

The controller unit utilizes conventional 3-15 psi signal air pressure, has a 0-150% adjustable proportional band, may be direct-, reverse- or snap-acting without parts change. The *Flexotrol* Level Controller can also be converted to a transmitter-controller combination. Automatic reset and rate response are optionally available.

Full details are given in Bulletin 456-1. A copy is yours for the asking.

*Flexotrol is a trade-name of Kieley & Mueller, Inc.

K&M

diaphragm control valves

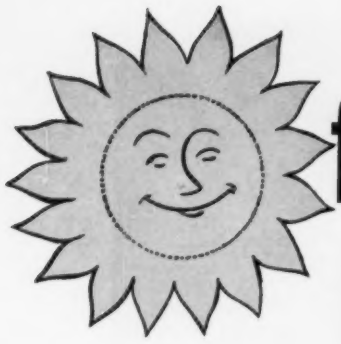
Our 80th Year

KIELEY & MUELLER, INCORPORATED

Oldest Pressure and Level Control Valve Manufacturer

64 Genung Street, Middletown, New York

SA. 1935



for heating... for cooling...

install America's best selling FIBRE DUCT!

SONOCO
SONOAIRDUCT®
FIBRE DUCT

ABOVE PHOTO—Taylor University, Upland, Indiana; Oris Eash, Fort Wayne, Ind., architect

Let the original fibre duct—SONOAIRDUCT—help you save time, labor and money on slab perimeter heating or combination heating and cooling systems. Initial cost is low and installation is fast because the lightweight, long lengths are easy to handle and level. There are no sharp, cutting edges, and SONOAIRDUCT will not crack, chip or break when dropped.

Available in 23 sizes — 2″ to 36″ I.D., in standard shipping lengths of 18′. Special sizes also available. Can be cut to exact lengths with hand saw. SONOAIRDUCT meets and exceeds F.H.A. criteria and test requirements for products in this category. Free installation manual sent on request. See our catalog in Sweet's.

SONOCO
Construction Products
SONOCO PRODUCTS COMPANY

- HARTSVILLE, S. C.
- LA PUENTE, CALIF.
- MONTCLAIR, N. J.
- AKRON, INDIANA
- LONGVIEW, TEXAS
- ATLANTA, GA.
- BRANTFORD, ONT.
- MEXICO, D.F.

499

Copying our FIBERGLAS* idea is not enough...

to have a whisper QUIET power roof exhauster like our SUPER/AIR-VAN® you must have—

U. S. Pats. 2188741, 2526290
Pats. Pending

- ► A research-developed, aerodynamic design.(but this is patented and cannot be copied.)
- ► A patented, scroll design to give efficient performance to 4" S.P.
- ► A true Venturi inlet.
- ► Glass smooth air passages.
- ► Custom designed motor isolators.

Then and only then will you get the whisper quietness of the first power roof exhauster in FIBERGLAS.

CAPACITY 100-12,000 CFM.
STATIC PRESSURE TO 4".

Units with less than 12" wheels do not carry AMCA seals because AMCA test codes do not apply to these small units.

CERTIFIED RATINGS
AMCA

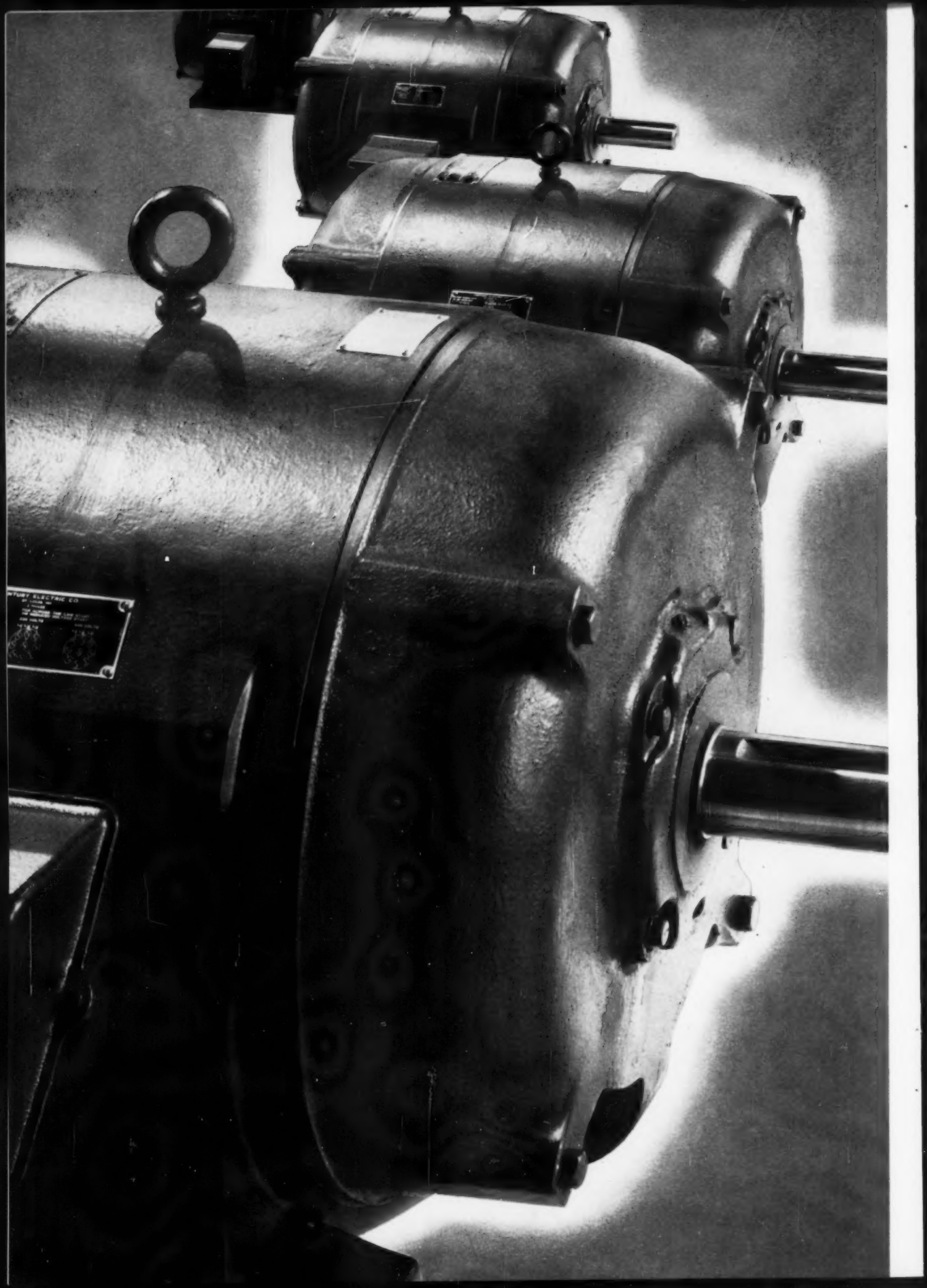
Innovation *not* imitation

GALLAHER

The Gallaher Company 4108 Dodge Street Omaha, Nebraska

More than 100,000 Gallaher Air-Vans Have Been Installed.

*TM Owens-Corning Fiberglas Corporation



1959–15,000,000 horsepower
1965–26,000,000 horsepower

Conservative estimates place the total horsepower of all motors driving fans and blowers in the United States at about 15,000,000 horsepower. And in 1965 it is estimated that the total will be about 26,000,000 . . . an annual growth of 5% for the air moving industry. To make sure all this equipment gives top performance requires careful matching of motor to equipment . . . and a wide variety of different types of motors. Century Electric application engineers can help you select the right motor for your fans, blowers and allied equipment:

For fans—Two basic types of motors, CS and CP, meet most requirements for fans operating from single phase power. Both these Century Electric capacitor start motors provide high starting torque. Fans operating from polyphase power perform best with SC and SCM motors.

For blowers—If the starting load is light or if there will be short time increases in load, then the Century Electric Type SC polyphase motor is ideal. It will give you enough starting torque, and with low starting current. It comes in 1/6 to 400 hp sizes. If you need two, three or four different fixed speeds while the blower is running, the Century SCM polyphase motor will do the job.

For compressors—Where high starting torque is required to overcome great inertia or backpressure, the Century Electric Type SCH polyphase motor is right. This motor comes in sizes ranging from three to 400 hp and in dripproof, totally-enclosed and explosion-proof enclosures. It also provides the right kind of power to drive reciprocating pumps with high starting torque requirements.

For pumps—Centrifugal pumps, whose torque demands increase with speed, perform best with Century Electric SC polyphase motors. Reciprocating pumps with high starting torque requirements need the SCH. For all types of pumps, as well as for compressors and blowers, Century Electric makes single phase motors.

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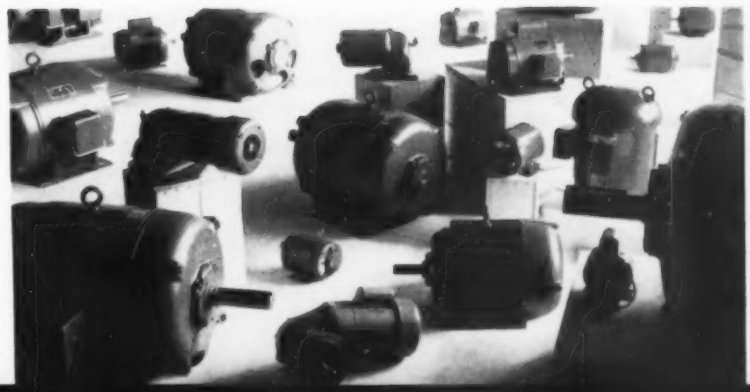

Naess and Murphy, architects-engineers, approved "Chicago" Airfoil Fans for the "high velocity induction" system of conditioned air used in this new newspaper building. 30 fans, on the top floors, handle air velocities of 5000′ per minute. Quieter operation and greater efficiency at less horsepower were the deciding factors.

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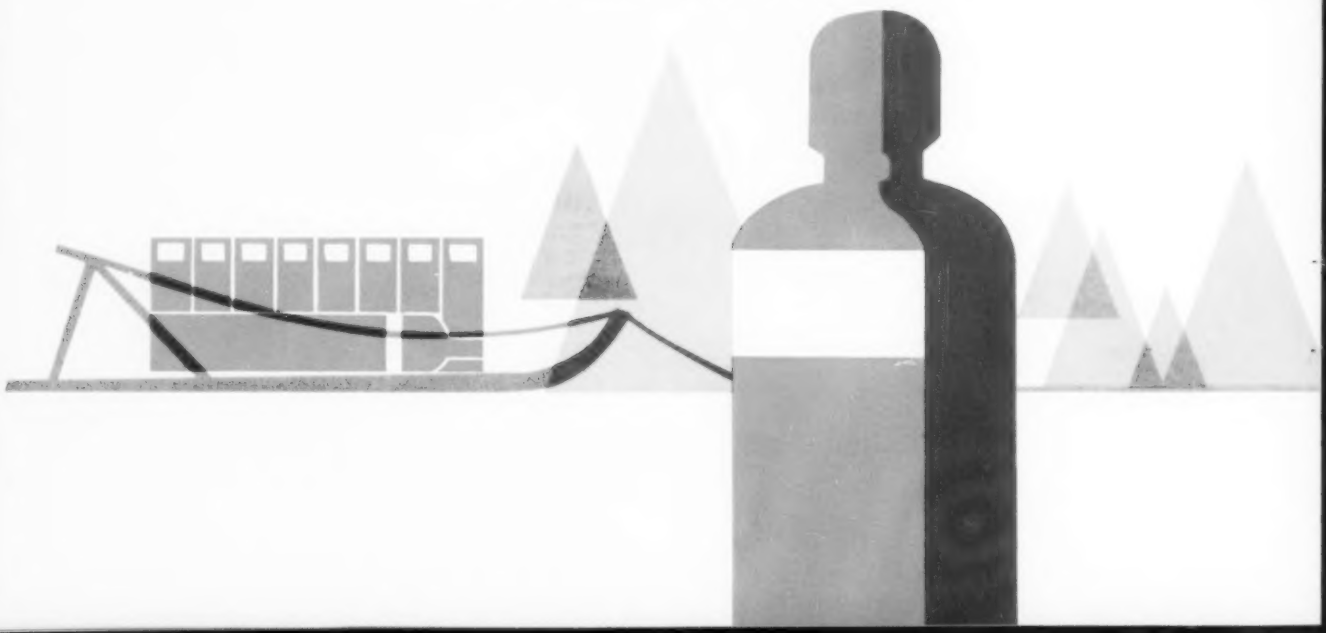

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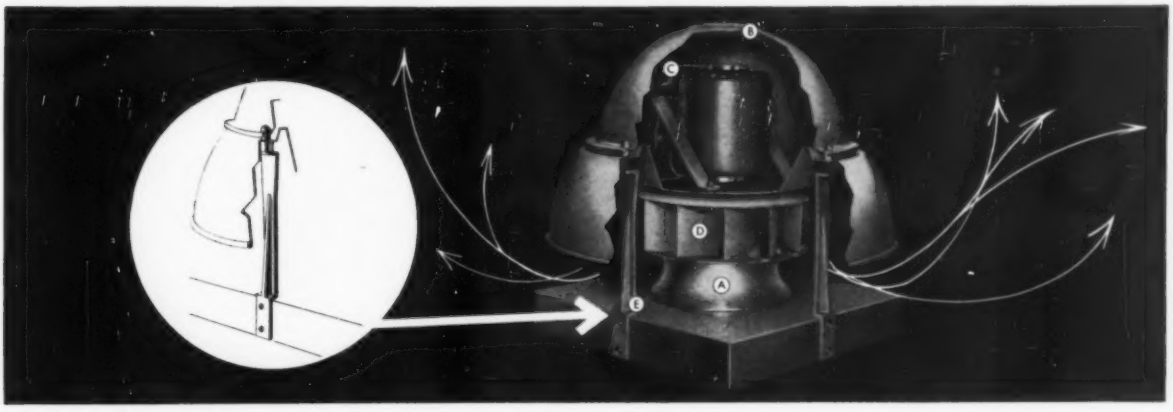

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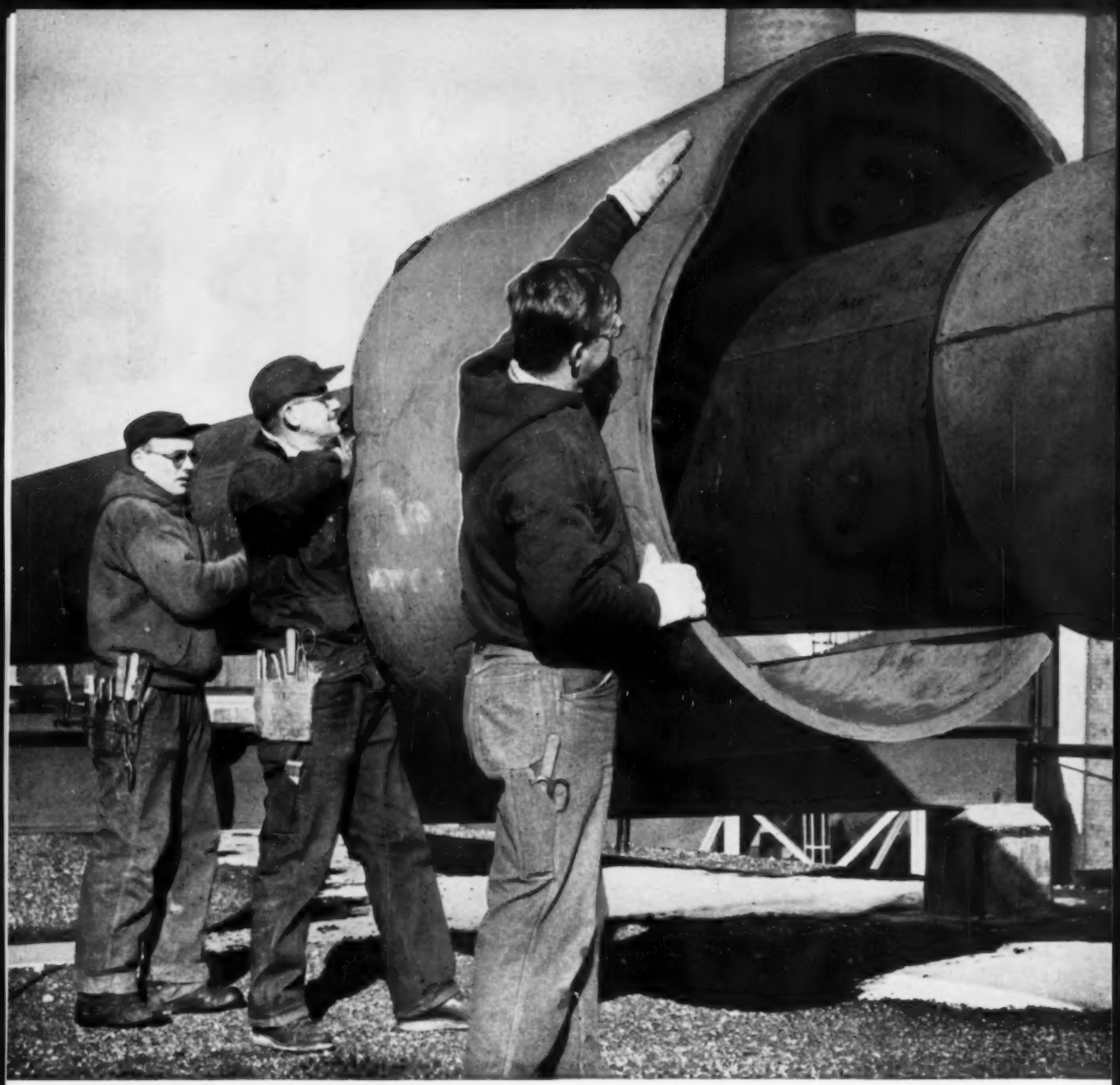

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Charleston Hospital Is Facing Same Problem Solved by Iowa Lutheran

IT APPEARS that the Iowa Lutheran Hospital, as discussed in the article *High Velocity Induction System Solves Hospital's Cooling Problems*, by Robert W. Flanagan (April), has met a situation that the Charleston General Hospital, Charleston, W. Va., is facing. We now have a 240 bed hospital crowded into very limited space. Our only air conditioning consists of 30 tons serving operating rooms, x-ray, and laboratories, 3 tons serving a classroom, and 18 window units serving various other rooms.

Our problem may be far greater than at Iowa Lutheran. We only have 8 ft, 4 in. ceilings, and most corridors are only 6 ft wide. The present radiation heating system is not designed for zoning and the building foundation will not support any additional load on the roof. There is just no space available for equipment. Just what can be done to the present building has not been analyzed, due to the lack of money.

We have $1.5 million with which to build an addition that will more than double our present floor space, thus bringing our hospital up to present-day standards for a 300 bed plant. It is hoped that sufficient money can be raised to air condition this entire addition, with plans to improve and add to present buildings in the future.

Mr. Flanagan's article gives no cost figures nor similar details on the Iowa Lutheran job. We would appreciate cost data on air conditioning installation in both new and old hospitals, showing cost per bed, per sq ft and per cu ft, for different types of systems and building construction.

We plan to enter this stage of planning with an open mind, and are willing to listen to all who may care to offer advice and suggestions.

J. A. MILLARD
Chief Engineer
Charleston General Hospital

THE AUTHOR'S REPLY — The type of building described does present many problems in air conditioning. I would not attempt to suggest an answer without first thoroughly studying the problems involved.

The Iowa Lutheran Hospital has a net floor area of approximately 50,000 sq ft being served by the 150 ton centrifugal refrigeration machine. High velocity systems account for approximately 100 tons of this load. The total of all contracts for the 150 tons of air conditioning, including the electrostatic filters, is approximately $210,000, or $1400 per ton. The system is serving 204 patients, all offices, cafeteria, all basement and sub-basement work areas, and storage rooms.

ROBERT W. FLANAGAN
Engineer
Daniel B. Stevenson, Jr.
Consulting Engineer

Spectrochemical Analysis Is Simple, Inexpensive Way to Check Weld Joints

HELMUT THIELSCH's article, *Weld Probe Sampling Programs of Graphitized Piping Are Still Your Best Guarantee of Safety* (March), very adequately discusses the problems which face plant engineers responsible for piping operating in the range of susceptibility. As he points out, the statistical aspect of a sam-

pling program is an important consideration in maintaining safe and continuous performance. The economics of extensive and repetitive sampling also enters into decisions reached as to the course of action which should be taken.

A relatively simple and inexpensive means of improving the statistical coverage in sampling weld joints of a piping system is available through the use of a spectrochemical analysis. In conducting examinations of various piping systems, it has been observed that lengths of pipe from the same heat of steel exhibit about the same degree of structural instability at any particular inspection. At least the variation between different lengths is no greater than that found around the periphery of a welded joint. Thus a preliminary spectrochemical check of each pipe section will permit a more orderly selection of representative probe specimens than would random sampling.

The procedure for accomplishing this is quite simple: Clean drillings, filings, or even a small piece of the pipe metal may be removed from the piping and submitted for spectrochemical analysis. Quantitative determination of the content of alloying elements, residuals as well as intentional additions, permits grouping of the pipe steels. Elements for which analyses are made usually include silicon, manganese, nickel, chromium, molybdenum, aluminum, copper, and vanadium. Other less common elements are detected quite readily by this means also. Usually, it is found that the pipe comes from several heats of steel, but, with this knowledge on hand, it is possible to select probe locations to check adequately every heat represented in the piping system.

With respect to forgings and castings, preliminary spectrochemical examination does not offer the same possibility of selective sampling. Each component in these categories is likely to be from a different heat of steel. However, since pipe constitutes the greater part of a piping system, the spectrochemical approach is readily justified in this area.

Additional information is available from spectrochemical examination which may influence a sampling program. High residual chromium and, to a lesser extent, manganese stabilize the carbide structure and hence make the steel less prone to graphite formation. In the other direction, high aluminum content increases susceptibility to graphitization and points up the need for early probe sampling. Further information relative to origin of material and to sensitivity to development of graphite are obtainable by McQuaid-Ehn grain size tests on small bits of metal from the piping. However, these studies can seldom be justified in checking the condition of a pipe system with a long service history.

E. A. Sticha
Metallurgical Engineer
Edward Valves, Inc.

The author's reply — Although we have performed extensive spectrochemical analysis tests on carbon-molybdenum steel piping involved in graphitization studies, we have not been able to predict accurately the absence or presence of graphite and, if present, the severity of the degree of graphitization.

There seem to be too many other variables involved which influence or prevent graphite formation and that do not depend on the chemical composition of the commercial carbon steel or carbon-molybdenum steel material. For example, we recently analyzed samples of power plants erected at the same time with piping furnished from the same heat of steel and of the same chemical composition. In one plant the pipe joints had severely graphitized while in the other no graphite whatsoever could be observed.

Our final conclusion was that probably differences occurred in the final heat treatment involved in the carbon-molybdenum steel piping systems. There was some evidence that, whereas in the graphitized system the final stress relieving heat treatment was conducted at about 1250 F, in the system in which graphitization had not occurred the final heat treatment was approximately 1325 F due to a slight though beneficial inaccuracy in the recording instruments which read approximately 75 F lower than they were supposed to read.

We also know of numerous instances where one end of the pipe is severely graphitized while the other contains no graphite, even though the chemical composition on both ends of the pipe, as analyzed by wet analysis and spectrochemical analysis, is essentially the same.

Helmut Thielsch
Metallurgical Engineer
Grinnell Co., Inc.

Coil Freeze Damage Can Be Reduced If Design Suggestions Are Followed

John H. Clarke's *How to Design Makeup Supply Air Systems for Freeze Protection* (April) is both timely and well done. Without a doubt, damages to coils would be greatly reduced if his suggestions were followed by design engineers.

Many installations are improperly designed, not through lack of good intent, but rather through habit. Undoubtedly, every engineer will object to this statement, but they, like some manufacturers of 100 percent makeup air units, are guilty of trying to convert units and designs that were originated to supply only heat to a building by a recirculating system.

Such statements become obvious if one only studies the construction of packaged units that have insufficient bypass area, compactness of construction that does not allow suitable duct connections, and other "features" that result in poor or reduced air flow through the unit. The same is true of the design of the ductwork and piping in the majority of installations.

All of the things Mr. Clarke writes about have been

known for years. However, the problem was not serious in most cases as long as the units were recirculating room air. It is true they did not always provide the Btu calculated, but usually the manufacturing processes supplied the extra heat. If the space became too warm because of failure of the control system to function properly, the unit was shut off and forgotten.

With 100 percent outside air supply the situation is actually different, but unfortunately the majority of installations are still made without any consideration being given to the basic fact that water freezes when the temperature is below 32 F or that water will not flow out of a container when there is a vacuum present.

All of us in the field should be indebted to Mr. Clarke for his excellent article and for his attempt to bring to the attention of those responsible for the design of equipment and installations that units handling 100 percent outside air must take a more definite stand to prevent freezing.

K. E. Robinson
Ventilation Engineer
General Motors Corp.

The author's reply — Mr. Robinson's comments are succinct and to the point. His comment that "All of the things that Mr. Clarke writes about have been known for years" should be noted. This is indeed true and points up the fact that engineers, while being alert to changing conditions and modern equipment, should not ignore the lessons of the past.

It is unfortunate that in our profession each generation goes through a pattern of "muddling through" and rediscovering some of the basic facts of design that many of our elders consider to be elementary parts of everyday design. Learning in a profession should be a continuous process. It could be supplemented greatly by curiosity — looking about us and learning from others. Over the years it has been my good fortune to have had some wonderful teachers.

John H. Clarke
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.

Put Fan in Convenient Space Where Ambient Temperature Isn't Too High

In the April Question of the Month there appeared answers to the question "*What Is Best Induced Draft Fan Location?*" I would like to submit still another answer for D. H. S.'s consideration.

On some of our units, up to about 2 million Btu per hr, we build the induced draft fan right into the unit. This seems more economical than to put it elsewhere. On the large units, up to 8 million Btu per hr, we make provisions to put it on the smoke pipe just outside the casing if desired and sometimes over by the chimney. It makes no particular difference except that if the joints of the smoke pipe are not tight, and gases are pushed through the pipes, some of the gas will be pushed through the joints into the furnace or boiler room.

Some engineers indicate they want the induced draft fan discharging directly into the chimney. This puts the smoke pipe under suction. So if there is a leak it pulls air in instead of driving gases out. It probably doesn't make any difference whatever as to the location of the fan. It will work in either place or half-way between.

The answers presented in the April issue give good advice against avoiding abrupt turns as much as possible. That is not always a simple matter. If the fan is sufficiently strong to overcome the extra friction and resistance, a problem still can be handled.

In general, I would say the fan should be located in the most convenient space for dependable service and in a place where the ambient temperature is not too high for the good of the motor.

E. K. Campbell
Chairman of the Board
E. K. Campbell Co.

Several Ways to Keep Sal Ammonia From Entering, Depositing on Fan

Regarding the Question of the Month "*How Can Fan Be Cleaned?*" (June), I would like to offer C.S.G. still another answer.

Sal ammonia is a hygroscopic material which tends to adhere to ducts, fans, and other air handling equipment. Air temperature, pressure, and flow rate as well as particle size, affect performance and selection of equipment used for its removal. C.S.G. has not given this information, so the following remarks may have to be modified to satisfy existing conditions.

Several means are available for preventing sal ammonia from entering and depositing inside the fan. These include filtering, mechanical separation, air washing, and electrostatic precipitation.

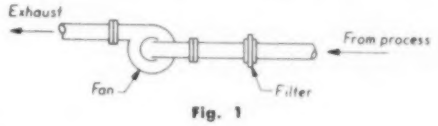

Fig. 1

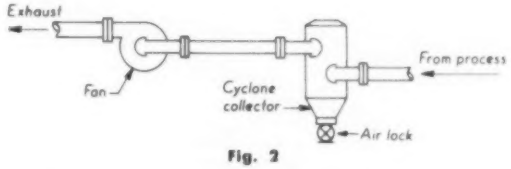

Fig. 2

Filters may be employed for low air flow rates. Face velocities of 300 fpm are typical, with pressure drops of approximately 0.1 to 0.2 in. water gage. Since a small mesh is required, high resistance to air flow results, requiring fans capable of satisfying these conditions. Filters may be the impingement or viscous type,

fabricated from fiber, screen, wire or mesh. They may be of unit design that are manually cleaned, automatic moving curtain type, or replaceable.

Unless a batch process is involved, installation of one or more spare units is necessary to permit continuous operation while a filter is being cleaned or replaced. For continous operation, a bypass must be provided to allow uninterrupted air flow during cleaning. Fig. 1 shows a typical arrangement.

Separation may also be obtained by a cyclone collector. Changing air flow rate and particle size influences efficiency of separation. Usually, cyclones have greater first cost and require more space than a filter. But they need less maintenance. Fig. 2 shows details.

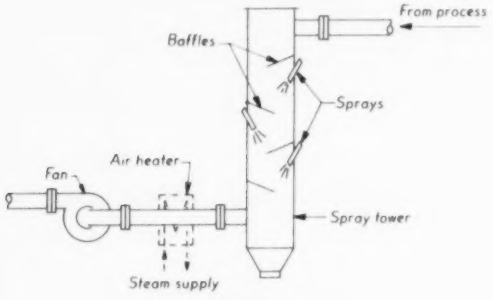

Fig. 3

For high air flow rates, air washing may be used. This method does not have the limited capacity characterized by filters and cyclones. Variation of sal ammonia concentration in the air stream may be cared for by an available wide operating range without requiring additional facilities or extensive adjustment of installed equipment. Fig. 3 shows principal components for a simple design. An air heater may be installed if humidity control is needed.

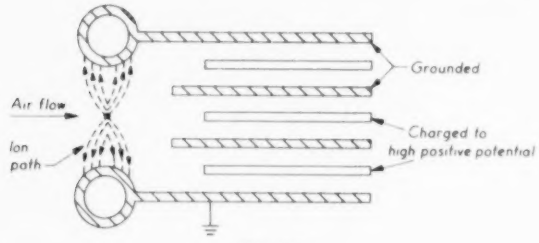

Fig. 4a

Electrostatic precipitation is an efficient method for removing particulate matter from a moving air stream having flow rates of 25,000 to 50,000 cfm. These units are available in ionizing and charged media types. With the former, particles receive a charge by passing through an ionizing zone employing 5000 to 6000 volts for plate charging and 10,000 to 12,000 volts for ionizing the field. Fig. 4a shows details.

The charged media design indicated by Fig. 4b has

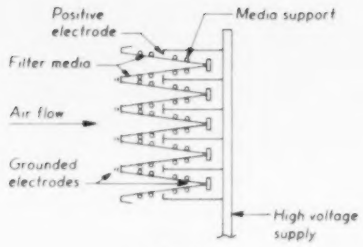

Fig. 4b

the energized collected medium induce a charge on the particles at 12,000 volts.

With either type, air flow resistance increases with particle accumulation, requiring periodic cleaning. Best results are obtained in atmospheres having relative humidity not exceeding 70 percent. Since these designs require a source of high voltage direct current, transformers, rectifiers and an extensive arrangement of cables and collector assemblies are needed. This results in high first cost and large space.

If he knows his thermodynamic properties and flow rates of air and fan characteristics, C.S.G. can obtain proposals for furnishing this equipment. Comparison of first and operating costs, as well as performance data for the respective schemes, will permit selection of a suitable arrangement.

H. B. Wayne
Consulting Engineer

Set Up Scheduled Maintenance Program for Frequent Water Washings

As another answer to C.S.G.'s fan cleaning question, our suggestion would be that he set up some type of maintenance program whereby the fan is washed with warm water on a regular schedule, depending on the severity of the condition. If this is done and providing he does not have other chemicals passing through the fan, this should solve his problem.

H. F. Thomas
Chicago Blower Corp.

Dilution of Odors with Outside Air Isn't the Only Way to Control Them

Albert B. Hubbard's *Winning the Air Conditioning Odor Fight—Round 6* (June) assumes that the only way to control odors is to dilute them with outside air. This is contrary to fact. An excellent way to control odors is to recirculate the air within the space and remove the odors by adsorption in activated charcoal. This permits odor control (ventilation) to be handled separately from heating or cooling.

Outside air is used only when it has the advantage of being at the right temperature. When it would add to the heating or cooling load, recirculation and activated charcoal air purification can be used.

H. L. Barnebey
Vice President
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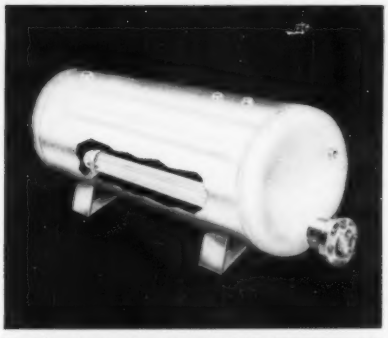

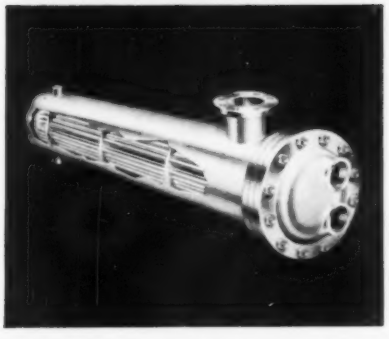

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RICHMOND ENGINEERING CO., INC.

question of the month

"Will Anti-Freeze Harm Boilers, Greatly Affect Heat Transfer?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"We are installing packaged hot water heating boilers in five buildings remote from the boiler rooms. The buildings are to be heated with a hot water heating system filled with 42 percent ethylene glycol solution. We are using an anti-freeze with the following analysis:

Ethylene glycol, percent by weight, min.	*90.3*
Diethylene glycol, percent by weight, min.	*5.0*
Total glycols, percent by weight, min.	*95.3*
Borax (decahydrate), percent by weight	——
Borax (pentahydrate), percent by weight	*1.9*
Water, percent by weight, max.	*2.8*
Dye, grams per gal	*0.3*
pH, 30 percent solution	——
pH, 50 percent solution	*7 to 8*
Reserve alkalinity	*14.2 to 15*
Freezing point, F	
50 percent solution	*34*
30 percent solution	——
Specific gravity, 77 deg at 60 F	——
Specific gravity, 25 deg at 25 C	*1.118 to 1.122*

"The boiler manufacturer has withdrawn the warranty on the boilers because the system is using this solution instead of water.

"We would like to know if any other readers have had any experience using an anti-freeze in boilers, and if so, if it will harm the boilers or materially affect the heat transfer."
—R.T.F.

Heat Transfer Rate Will Be Lower; ASME Power Boiler Code Sets Rules

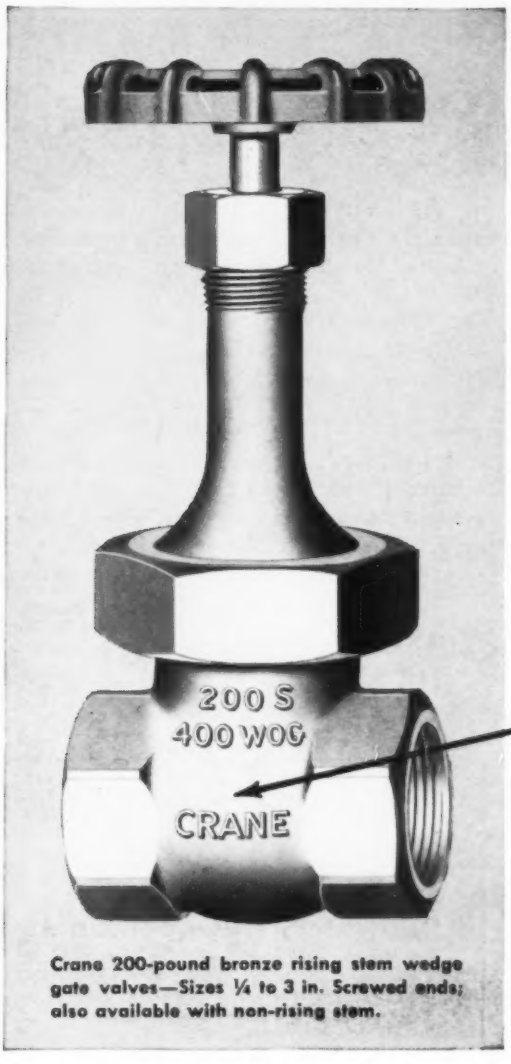
A BOILER MANUFACTURER may have several valid reasons for withdrawing his warranty on boilers which are to be used for heating a solution of ethylene glycol instead of water. Among the reasons are:

1) The inquirer may propose to use boilers built under the rules of the American Society of Mechanical Engineers Low Pressure Heating Boiler Code. The ASME Boiler and Pressure Vessel Committee stipulates that boilers built under that section of the Code may be used for low pressure steam operation and for hot water heating and hot water supply service. The committee requires that the rules for the construction of power boilers shall be used "for conditions exceeding those specified."

R.T.F. proposes to use the boilers for heating a liquid other than water and this places the boilers *outside* the scope of this Code. Therefore he should plan to use boilers built under the rules of the ASME Power Boiler Code, assuming that the applicable boiler laws require compliance with the ASME Code.

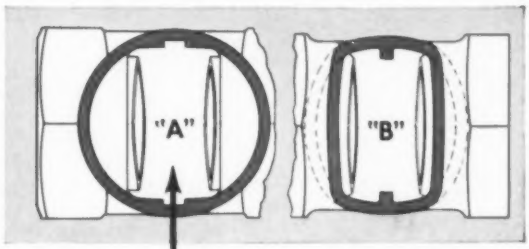
2) The film coefficient, which is one of the controlling factors in heat transmission, is lower for an ethylene glycol mixture than for water. The figures mentioned herein will be based on a 50 percent solution because published data is available on that concentration. The figures for a 42 percent solution would probably be slightly more favorable.

The film coefficient for the 50 percent mixture is



Crane 200-pound bronze rising stem wedge gate valves—Sizes ¼ to 3 in. Screwed ends; also available with non-rising stem.

Crane cylindrical body design ("A") distributes pressure load uniformly, resists distortion, prevents possibility of seat leakage under higher pressures. In ordinary, rectangularly shaped bodies ("B"), stresses concentrate where walls have shortest radius. Leakage and early failure may result from excessive deflection, and rupture may occur.



HERE

CRANE adds new strength and safety to 200-Pound Bronze Gate Valves

Here is a bronze gate valve body design that provides essential strength where internal pressures are greatest . . . where line strains are most likely to concentrate.

And that's not all you get. The Exelloy seat rings are expanded into the body so that they can't loosen. There are wider hex ends which give easier, firmer wrench grip and resist distortion.

Another quality feature that Crane offers is the shoulder at the bottom of the threads in port ends to restrain the excessive entry of pipe that could cause damage to the valve seats.

You will find many uses for Crane 200-pound bronze gate valves in your plant—on steam, water, oil, gas, air, gasoline, light oils and volatile fluid lines.

For complete information about these new Crane bronze valves, see your local Crane Representative, or write to address below for Circular Ad-2285.

Send for Circular Ad-2285 today.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Illinois—Branches and Wholesalers Serving All Areas

about 29 percent lower than for water under the same conditions of temperature and the same rate of circulation of fluid across the heating surfaces. Therefore a boiler intended for heating this mixture should have about 29 percent more heating surface than a boiler intended for heating water under the same conditions.

Boilers of the type under consideration usually depend on natural circulation. The heat transfer could be increased by raising the velocity of fluid circulation across the heating surfaces. The velocity of circulation of the mixture would need to be about 2.6 times as fast as for water to result in the same heat transfer. Another way to increase the heat transfer would be to increase the temperature difference between the heated fluid and the products of combustion. This would result in a higher exit gas temperature and lower efficiency and could result in "hot spots" in the boiler. R.T.F. may refer to *Applied Heat Transmission*, by H. J. Stoever, Case No. 8 (McGraw Hill Book Co., Inc., 1941), for further details regarding this phase of the problem.

3) The boiler manufacturer probably does not have enough experience with this problem to be certain that the ethylene glycol solution will remain stable indefinitely under conditions which may develop in the boiler; as for example, in the case of a "hot spot" resulting for any reason.

4) Many people, including myself, believe that a solution of ethylene glycol will leak through openings which would not leak water. This condition is encountered frequently by motorists who find that automobile cooling systems leak anti-freeze solution although tight for water.

The writer's company has supplied many boilers for use in systems where ethylene glycol solution is the heating medium in parts of the system. Boilers for this service have been supplied with heat exchangers installed to heat the ethylene glycol solution. We would not knowingly supply a low pressure boiler of our manufacture to be used for heating any liquid except water.

J. W. Turner
Consulting Engineer
National-U.S. Radiator Corp.

Ask Manufacturers of Ethylene Glycol Equipment to Recommend Inhibitor

We can readily understand the boiler manufacturer withdrawing his warranty on the boilers due to the use of this solution. Ethylene glycol is corrosive and could undoubtedly affect the valve seats, pumps, connections, etc., that go to make up a boiler-burner unit.

The only way out of this is to use a corrosive inhibitor with the solution. By doing so, no difficulty should be encountered unless the inhibitor is used up and the ethylene glycol solution becomes full strength again.

We suggest that R.T.F. contact the manufacturers of the ethylene glycol solution equipment to determine the type of inhibitor to be used and the method of application.

Gilbert Nellingann
Manager of Field Sales
Fitzgibbons Boiler Co., Inc.

Avoid Heating Anti-Freeze in Boiler; Should Use Separate Heat Exchanger

Our experience and record of use of ethylene glycol anti-freeze in heating boilers is limited. We would not approve use of it in our boilers. We recommend that a separate heat exchanger be used for heating the anti-freeze.

According to P. B. Gordon, vice president of Wolff & Munier, Inc., mechanical contractors, "Whenever possible, avoid heating the anti-freeze solution in a coal, oil, or gas fired heater or boiler. Use a heat exchanger with hot water below 285 F or steam below 40 psig as the heating medium."

Raymond W. Williams
Boiler Engineering & Supply Co., Inc.

READER ASKS —

"Do Entry, Exit Coefficients Have Different Values?"

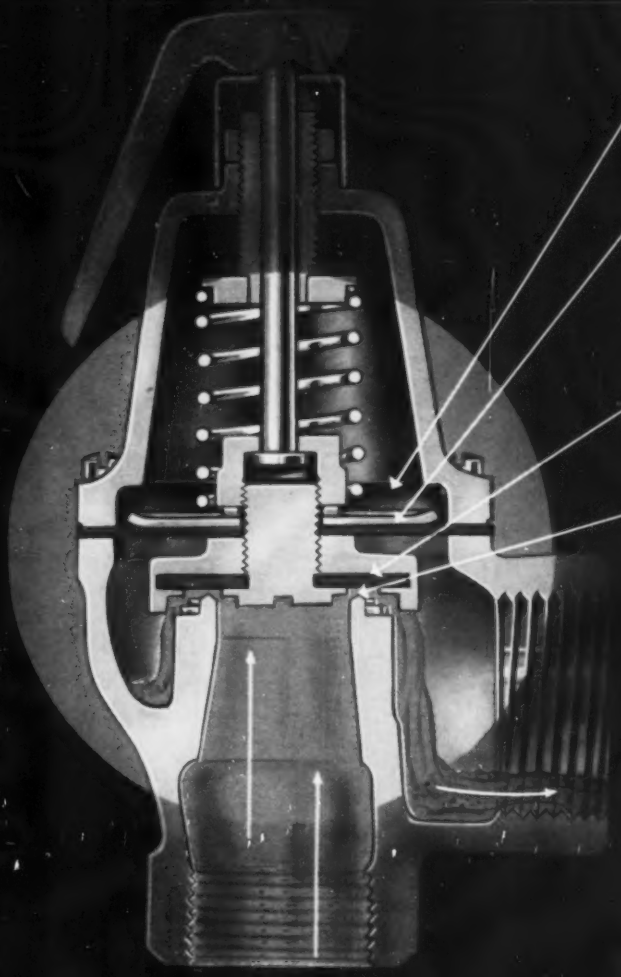
"Figures showing the entry and exit losses and coefficients of entry and exit have been available for a long time. It has been stated by most authorities that the values of losses and the coefficients for fluids flowing into and out of various kinds of orifices are the same.

"However, not long ago, I noticed a table put out by a well-known authority which showed values for entry that were markedly different from those of exit.

"Maybe a little discussion on this would be apropos."—B.A.R.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

WATTS
No. 174A



Double-Safe Design — No mechanical guides—not diaphragm operated.

Water Seal — Provides precise alignment of seal to disc and eliminates need of hazardous mechanical guides which can stick or freeze a valve shut from lime or corrosion. Seal also protects spring working parts from water or steam during relief.

Stickage-free Disc-to-Metal Seating — heat resisting, stickage-proof silicone disc material.

Pop Action Operation—All Watts A.S.M.E. rated relief valves operate by pressure exerted directly against the disc to pop the valve wide open for steam relief. The full rate of discharge is immediately reached at the set opening pressure and does not depend on further pressure accumulation as in some other designs.

WHAT DO YOU LOOK FOR IN ASME PRESSURE SAFETY RELIEF VALVES?

ENGINEERING DESIGN

The most advanced design in A.S.M.E. rated pressure relief protection for hot water boilers is the new *Double-Safe* design of Watts Valves.

These are water pressure relief valves with an *emergency* steam rated pressure safety relief feature. They will discharge excessive water pressure created by thermal expansion and also excessive steam pressure in the event of emergency temperature conditions.

FULL SELECTION OF SIZES

Watts offers the most complete line of boiler safety relief valves with the 174A Series and 74A-740 (expanded outlet) Series. Designed to meet the smallest or largest requirements for pressure protection from one line of valves, Watts A.S.M.E. Rated Relief Valves furnish complete protection for the great majority of hot water heating and supply boilers *with a single valve.*

Watts Regulator Company • Lawrence, Massachusetts

Watts A.S.M.E. Rated Pressure Relief Valves are available in capacities from 500,000 BTU/HR to 14,370,000 BTU/HR with valve settings from 30 to 150 lbs.

Be on the safe side with

WATTS

Protection and Control Specialties

For complete Specifications,

Ratings, and Application Information on Watts A.S.M.E. Rated Valves, see your wholesaler or send for Bulletin F-ASME.

These buildings have one thing

Statler-Hilton Hotel, Dallas. Architects: Wm. B. Tabler & Associates; Engineers: Jaros, Baum & Bolles; Contractor: Robert E. McKee.

● Just one or two types of air filters couldn't possibly meet the widely varied clean-air requirements of all these structures. One of the buildings alone required *four* different types—each meeting a specific need.

AAF is uniquely able to meet *all* the clean-air needs of *all* these buildings because only AAF makes *all* kinds of filters. Thus, with AAF you are always assured of getting the *one right* filter for every application—the *one* filter engineered and constructed to give you the *efficiency you need plus the maintenance characteristics you want.*

For product information on the complete line of AAF filters, call your local AAF representative or write direct for Bulletin 510A. Address: Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Ave., Louisville, Ky.

in common:

CLEAN AIR *by AAF*

AIRPORT

Cleveland Hopkins Airport, Cleveland. Architects: Outcalt, Guenther & Associates; Contractor: The R. S. Ursprung Company.

CHURCH

St. Luke's Methodist Church, Oklahoma City. Architects and Engineers: Coston, Frankfurt & Short; Contractors: White and Messer, and Mid-Continent Mechanical Contractors, Inc.

OFFICE BUILDING

Tishman Building, New York City. Owner and Builder: Tishman Realty & Construction Co., Inc.; Architects: Carson & Lundin.

NEWSPAPER

Sun-Times Building, Chicago. Engineers: Noess & Murphy; Contractor: R. B. Hayward Co.

HOSPITAL

Swedish Hospital, Seattle. Architects: Naramore, Bain, Brady & Johanson; Engineer: C. A. Pangborn.

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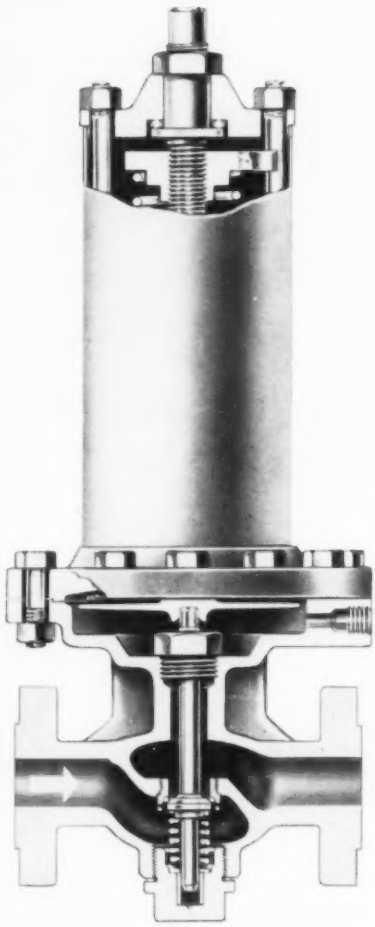
TWO NEW CONCEPTS IN

NEW LESLIE-TOPPER® VALVE DESIGNED WITH PILOTING DEVICE ENTIRELY *OUT OF THE PATH OF STEAM*

The new Leslie Topper self-contained pressure reducing valve offers a new level of accuracy, simplicity and low-maintenance service (see chart below). Key to this revolutionary valve is a piloting device which is entirely out of the path of steam. Because this mechanical pilot is sealed-off from the steam and all valve parts are designed without dirt-catching passages, the new Topper valve is ideal for both poor steam conditions and intermittent duty.

It can handle low-reduced pressures and is used in process lines, steam heat reducing stations and for make-up steam supply to heaters, gland sealing system and process equipment. You benefit from added reliability, plus the accuracy of a pilot operated valve and the rugged simplicity of direct operation. It means less shut-down time for maintenance, surer pressure control and increased plant efficiency.



SPECIFICATIONS

Sizes, Body Materials and End Connection:
½—2", cast iron, and bronze, screwed, 150 and 300 lb. bronze, flanged.
1—2" 125 and 250 lb. cast iron, flanged bodies.

Three Spring Ranges: *2-10 psi; 5-20 psi; 15-35 psi.*

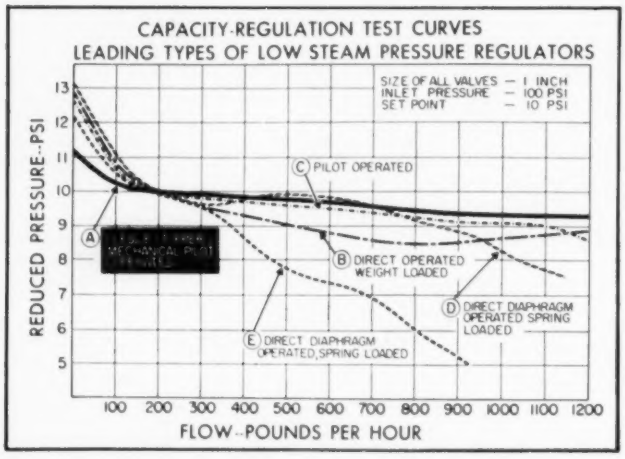
Long-travel metal diaphragm: *2 ply, phosphor bronze, Spiro-flex.®*

Main Valve: *Hardened 440C stainless steel.*

Seat Ring: *Stellited stainless steel.*

Stem Guides: *Gun metal bronze (top and bottom guided).*

Main Valve Spring: *Inconel.*



For sizing and capacity data, contact your Leslie Engineer or write for Bulletin 582.

LC-8

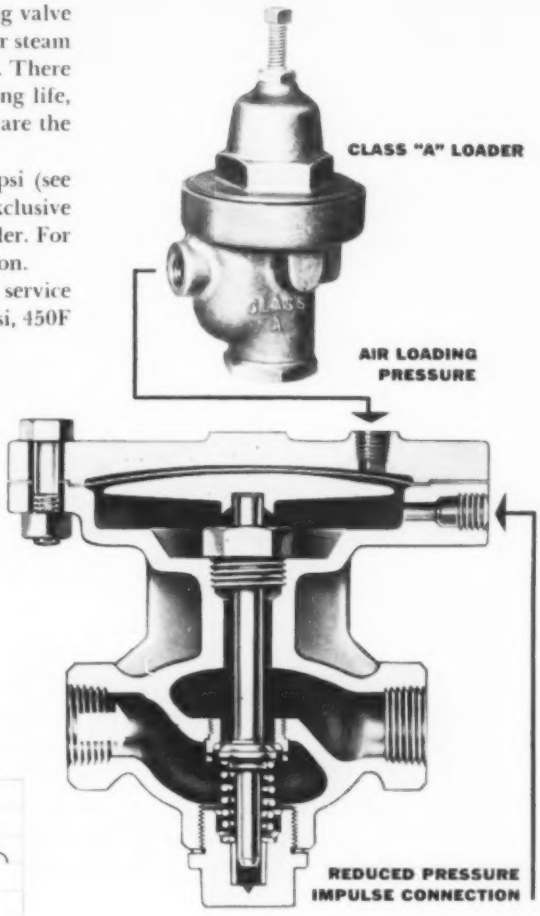
PRESSURE REDUCING VALVES

LESLIE AIR-LOADED REDUCING VALVE GUARANTEED MAINTENANCE-FREE FOR THREE FULL YEARS

New Leslie air-top GPK diaphragm operated, pressure reducing valve is guaranteed maintenance-free for three full years. Designed for steam heat or process steam application, it has only two moving parts. There are no seals, no stuffing boxes, no small dirt catching parts. Long life, long-travel diaphragm and hardened stainless steel main valve are the only parts that move.

You get accurate response even to flow changes as small as 0.1 psi (see chart below). This exceptional responsiveness results from exclusive diaphragm design and the accuracy of the simple Leslie air loader. For added flexibility, pressure can be adjusted from remote location.

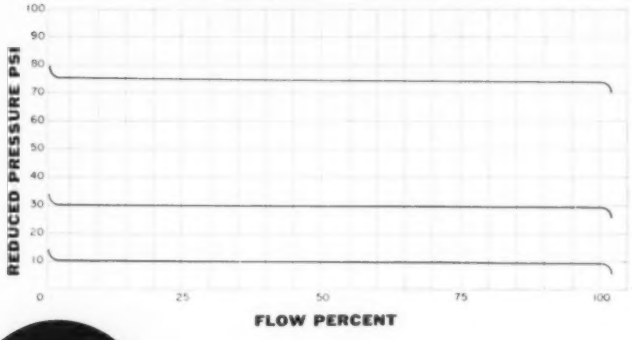
Especially desirable for poor steam conditions and standby service requirements, the GPK is suitable for steam service up to 250 psi, 450F and is available in ½" to 4" sizes.



SPECIFICATIONS

Sizes: *½ to 2", cast iron or bronze, screwed ends. 2½, 3 and 4", cast iron, 125 or 250 lb. flanged.*
Main Valve: *Hardened 440C Stainless Steel.*
Seat Ring: *Stellited Stainless Steel.*
Stem Guides: *Gun Metal Bronze (top and bottom guided).*
Main Valve Spring: *Inconel.*
Inlet Pressure Range: *0-250 psi, 450°F.*
Reduced Pressure Range: *0-85 psi with Class A loader, up to 249 ½ psi with any suitable high pressure loader.*
Minimum Pressure Drop across Valve: *½ psi.*
Available with manual opening device in sizes ½—1¼".

CAPACITY-REGULATION GRAPH



For sizing and capacity data, contact your Leslie Engineer or write for Bulletin 561-B.

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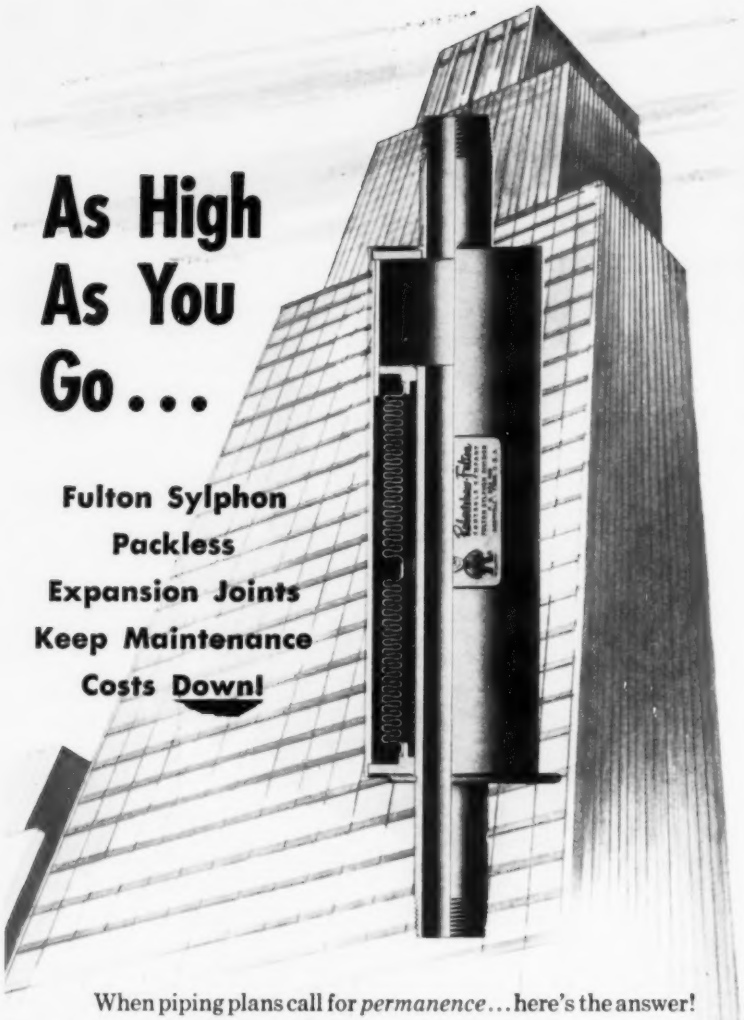
Fulton Sylphon Packless Expansion Joints Keep Maintenance Costs Down!



When piping plans call for *permanence*... here's the answer!

For vertical or horizontal pipe lines, for steam or hot water — wherever pipe movement's a problem — these packless joints provide *leak-proof movement* for lasting, trouble-free service. Studies of thousands of joints in major buildings show annual replacement less than 2%— even after 25 years' constant use! No wasted "loop" space; no constant repacking (and repainting): these quality-engineered joints "pay their way" many times over.

Available in ¾" to 3" sizes, with lifetime Robertshaw bellows of monel, copper or stainless steel.

For more information on Packless Expansion Joints for your specific need, write Dept. NH.

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Robertshaw-Fulton CONTROLS COMPANY

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ENGINEERS' GUIDE

Complete, easy-to-locate information including selection data, specifications and dimensional drawings. Send for your *FREE* copy today!

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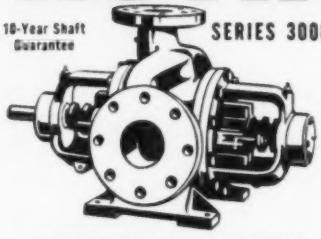

TURBINE POWER PLANT PUMP

PACKAGED BOILER FEED UNITS

HORIZONTAL CONDENSATE UNITS

VERTICAL CONDENSATE UNITS

UNDERGROUND CONDENSATE UNITS

CERTIFIED HOT WATER PERFORMANCE

Long, efficient, trouble-free operation under the most adverse conditions of usage, plus a wide range of stock models and capacities, have made ROTH Turbine Power Plant Pumps and Packaged Units the choice of thousands of heating engineers. The pumps are recognized for their superior hot water performance, (capacities and pressure *certified* upon request). Shafts are guaranteed for ten years against breakage. Cast iron or copper-bearing steel available on all vertical and underground units. Motors and controls of nationally accepted makes.

ROY E. ROTH COMPANY

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2452 Fourth Avenue

Rock Island, Illinois

"Diamonds by Cartier"

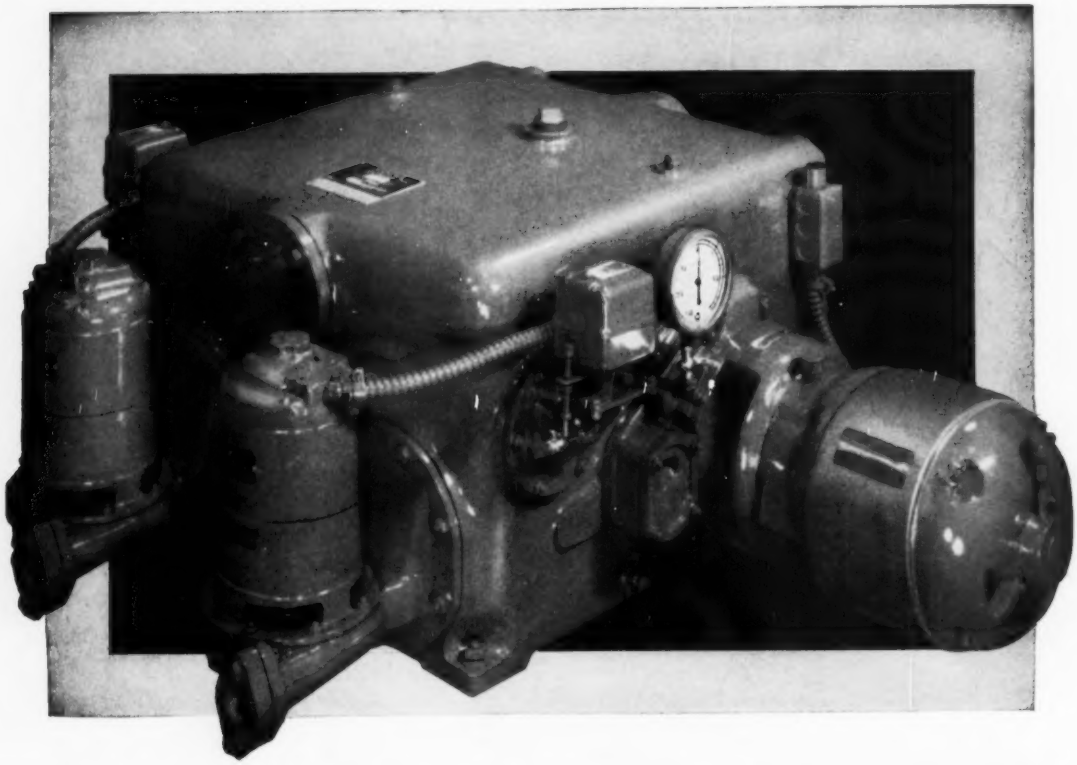
EXCITING THINGS ARE HAPPENING IN WORTHINGTON PACKAGED AIR CONDITIONING

New styling. New sizes. New features. Worthington is setting an exciting pace in improving and expanding its packaged air conditioning line. With a new emphasis on styling, comfort can be seen as well as felt. New design concepts reduce space requirements as much as 35%. And new factory-assembling and wiring techniques cut installation costs sharply. With these exciting new developments, Worthington has made packaged air conditioning truly universal in application—more than it has ever been before. But these are only some of the exciting facts. There are many more you'll want to hear about. Worthington Corporation, Ampere Station, East Orange, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ont.

12-20

WORTHINGTON

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

TYPICAL RECREATION room has radiant panel floor, plus baseboard radiation

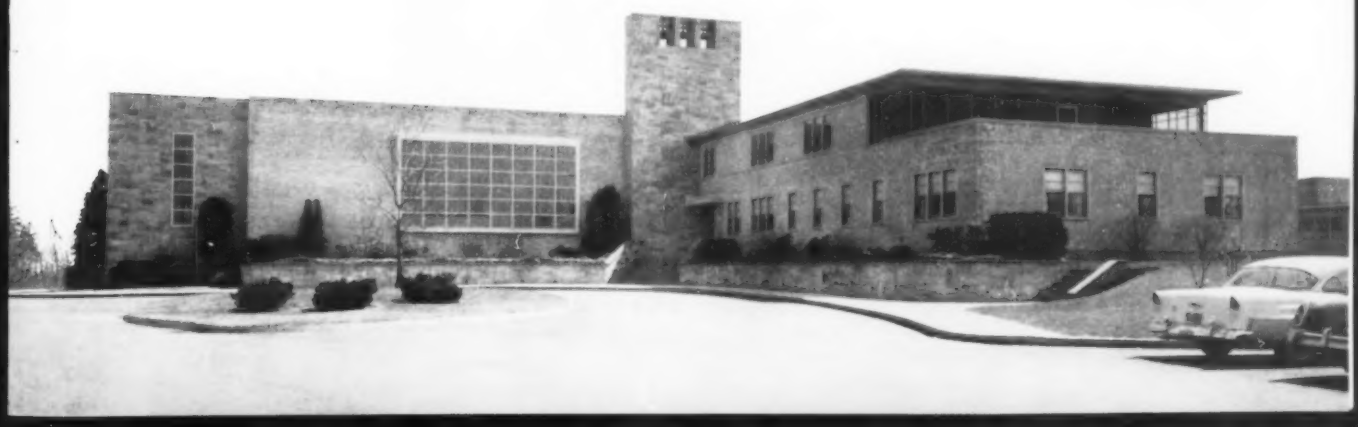
Wide Functional Needs of Orphanage Met by Variety of Heating Methods

. . . installed at low cost

BY ROBERT S. GLASIER
Stressenger, Adams, Maguire, and Reidy
Consulting Engineers

The NAZARETH Children's Boarding School, Boston, built to answer a long-felt need for a suitable shelter and school for orphans, includes living and service areas having widely differing requirements. At the planning stage the consulting engineers recognized this variety of function and designed heating and ventilation facilities that would suit individual areas within the architectural complex.

The result: an engineering design that includes, at different points,



warm air heating, radiant heating, and direct steam radiation, with high pressure steam generation and an assortment of special ventilation systems. And they did it at low first cost — only 14.5 percent of the total construction cost for the entire project.

The main building consists of 10 children's units that are nearly identical, a physical education wing, a service area, an administration and convent section, and a chapel. Chapel, service, and physical education facilities form a central axis from north to south. This is crossed between chapel and service areas by administration and convent spaces, and between service and physical education areas by the long, curving array of children's units.

Each of the units, called cottages, comprises bedrooms, baths, an infirmary, a Sister's room, a sewing room, a recreation room, a dining area, and a classroom. At the extreme ends of the row of cottages are two additional teaching areas, one for manual training and the other for domestic science. An engineer's residence is located south of the main building.

Soon after the project was completed, the Nazareth Auxiliary School was constructed on the grounds, oriented at right angles to the southern end of the central axis of the main building. After this addition had been completed and put into use, the classrooms in the cottages were made into social rooms. Later, a small garage building was added.

The main building contains a laundry and a kitchen, both requiring service steam. Mechanical ventilation is necessary in these areas and in the physical education wing, as well as in miscellaneous spaces throughout the project for which ventilation is required by Massachusetts and Boston codes.

High pressure steam was necessary for these facilities, and this determined the character of the heat generating plant. Of course, it would have been possible to use small individual boilers for high pressure steam generation. But since steam was required at two different pressures above atmospheric, engineering logic suggested the use of a central boiler plant in order to localize all combustion equipment, to save space, and to shorten piping runs.

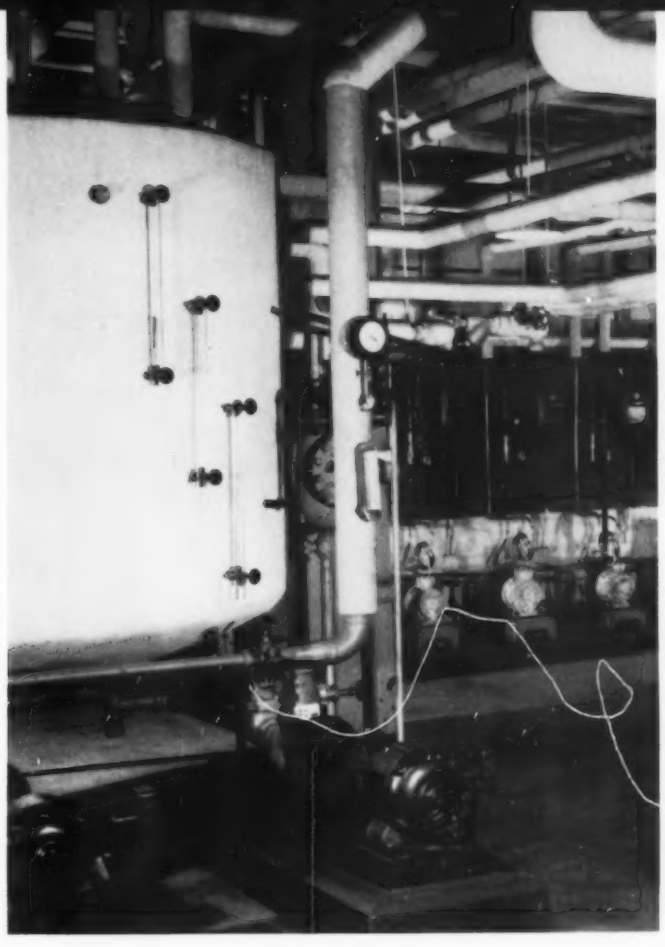
It was also desired to provide sufficient capacity for future construction. Therefore, central high pressure steam boilers were selected. With this system, steam is available for heating, either directly or for heating hot water.

In considering the type of system for heating the main parts of the in-

● With a general design objective of serving all the ordinary needs of an orphanage—including children's living quarters, classrooms, physical education facilities, a service area, an administration and convent section, and a chapel . . . all having widely differing requirements—the consulting engineers met the problem of heating this structure by designing a variety of individual systems, all served by a central steam boiler plant, according to the needs of the particular areas. Costing only 14.5 percent of the total construction, economies were effected by holding excavation to a minimum, the use of underslab insulation, and a centrally located boiler plant.

Mr. Glazier was with Slocum & Fuller during the time that firm designed the heating and ventilation systems for the Nazareth project. Today, he is a member of the recently formed Stressenger, Adams, Maguire, and Reidy organization.

CHILDREN'S units are served by three main pumps, 12 zone pumps which circulate water in radiant heating system



CENTRAL STEAM BOILER plant is located in basement of service area. Pipe spaces connect plant with all mechanical equipment rooms

stitution, it was necessary to consider first the principal division, the children's units. With many small children playing on the floors at times, warm floors were a necessity. Since no basement was needed, it was decided to install a low temperature radiant heating system in the floor using hot water. The area of radiant heated spaces exceeds 69,000 sq ft.

Since greater ventilation rates were required in the chapel, it was decided to use air as the heating medium in order to blend the system in with the architectural features. However, for the physical education areas, it was possible to provide ventilation air for use when the space was occupied, and direct radiation for heating to hold the temperature when not occupied.

For other spaces, such as the administration and convent areas, direct steam heating was selected as the most economical medium since there was plenty available and there was no reason to use an alternative.

Central Plant Supplies Steam

The central steam boiler plant serving the entire project is located in the basement of the service area, under the kitchen. Pipe spaces connect the plant to all mechanical equipment rooms and to piping spaces serving the different divisions of the institution. Piping extends underground in conduit to the auxiliary school and the engineer's residence.

A walk-through tunnel was provided under the whole length of the array of children's units; however, the volume of excavation beneath this, the principal area of the project both functionally and in terms of building space, was relatively small.

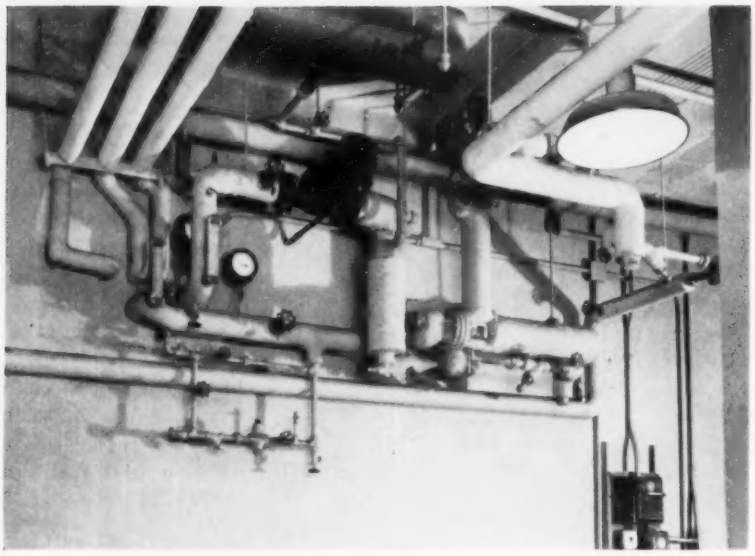
Size Boiler Plant for Tomorrow

In the boiler plant, steam is generated at 125 psig in two longitudinal drum, water tube boilers fired with No. 6 oil in steam atomizing burners. Because the boiler plant was to be located underground, where future expansion of the facilities would be difficult, it was decided to provide initially sufficient boiler capacity to absorb all the loads likely to be imposed by future construction on the site. Accordingly, two 300 hp boilers were installed.

The outside underground fuel oil tank battery stores 40,000 gal of heavy oil and 2000 gal of No. 2 oil, the latter being used for cold light-off.

Both forced draft and induced draft were provided. Induced draft equipment consists of an integral factory fabricated arrangement of two fans, one for each boiler, discharging into a single venturi type steel stack enclosed in masonry above the roof level.

Condensate from the various services is returned to a vented main receiver in the plant. The 100 psig returns from the laundry are passed through a duplex coil in the domestic hot water storage tank for extraction of useful heat on the way to the condensate receiver. Auxiliary pumps transfer the collected condensate to an open deaerating feedwater heater, from which it is drawn by the boiler-feed pumps and returned to the boilers. Dual pumping units, providing 100 percent standby, are employed for boilerfeed service, and a similar duplex arrangement delivers fuel oil from the tanks to the burners. Each of the dual units includes one electric



ENGINEER'S HOUSE is heated by entirely separate system. Convector and circulator (shown) are located in boiler room. Supply and return lines run underground.

motor driven machine; the second boilerfeed pump is driven by a steam turbine, and the second oil pump by a steam engine. The boilerfeed pump turbine exhaust is piped to the feedwater heater, and also to the low pressure steam heating supply mains.

Two oil burners are provided in each boiler. Light-off is manual; operation is governed by a pneumatic system of combustion control. Steam output and fuel oil flow are metered. A centrifugal blowdown separator is used instead of a blowdown tank. Water drained from the separator is piped to a sump, to which a controlled amount of city water is added in order to limit the waste water temperature.

Code Rules Ventilation Design

The ventilation code called for an air volume of 8600 cfm in the physical education wing. This is furnished by a horizontal ventilating supply unit with filters and nonfreeze steam heating coils. During full occupancy, an equal volume is removed by operation of a roof ventilator. Cast iron convector elements are recessed under the windows in special enclosures having inlet grilles and window stool outlets.

Temperature controls for this equipment are pneumatic. In the "night" position of the operator's selector switch, the air handling unit does not run; in the "day" position, it introduces a manually selected percentage of outdoor air. Space thermostats govern steam valves on the air heating coil and the direct radiation, and the exhaust roof ventilator remains under manual control.

The chapel contains no direct radiation, all heating and ventilating requirements being met by air handling equipment. In general, supply air is delivered around the perimeter, through window stool outlets, while returns are drawn from the interior.

Outdoor air intake louvers for this system and exhaust louvers for the laundry are located at opposite ends of the chapel bell tower. Three cycles of indoor control are provided for the chapel, these utilizing pneumatic elements. At night, the supply unit is cycled with steam valves open in order to maintain a holding temperature with recirculated room air; when heating alone is required in the daytime, the supply unit runs continuously, using recirculated air exclusively just as at night, while the exhaust fan remains off the line; and when the chapel is occupied and in full use, the operator may select a ventilating cycle under which both supply and exhaust will run and will admit (and remove) a manually preselected quantity of air.

The administration and convent section is heated with recessed cast iron convectors to which steam is admitted under automatic control. In the laundry located in the basement of this section, and likewise in the kitchen, large volumes of air must be exhausted from hoods and other intakes for the proper control of heat, odors, and vapors. In both these spaces, makeup air is supplied by fan units and is tempered as necessary. In the kitchen, steam convectors are provided as well.

Kitchen air supply units are suspended high in the boiler room. Roof ventilators are used for kitchen exhaust. The kitchen system uses 100 percent outdoor air whenever it operates. Heating and ventilation for the laundry are controlled in the same manner as for the chapel.

Heating the Children's Units

The children's units being the core of the institution, the details of the heating system serving this area are essential to discussion. Three main pumps and 12 zone pumps circulate water in the radiant heating system serving these units. Of the large pumps, each rated at 210 gpm, one is held in standby at all times. Each of the other two delivers to tunnel mains serving half the cottages. A steam-to-water heat exchanger is in each of the two main pumping circuits, located with the main pumps in a machinery room entered from the pipe tunnel. Zone circulators are installed in the piping out in the tunnel.

Each of the 10 cottages has its own zone pump; the other two circulators serve the domestic science and manual training areas, which are zones in themselves. A three-way valve upstream of the circulating pump in each zone passes a mixture of zone return and hot water from the mains. The pump delivers the mixture to the

zone coils, and replaces in the return main the quantity it has drawn from the hot water supply.

The success of this arrangement depends on a reasonably constant pressure difference between supply and return in the mains at each location of zone piping takeoff. Accordingly, a bypass valve is provided at each such point, positioned by a local differential pressure controller.

Provide Underslab Insulation

The zone sub-mains are enclosed in insulating concrete throughout the run between the tunnel and the radiant heating coils. Within a typical unit, most of the heating requirement is met with floor coils consisting of 1 in. steel pipe on 10 in. centers in a serpentine circuit. Floor coils were laid on a 4 in. thickness of insulating concrete. A 2 in. thick, 24 in. wide strip of glass fiber insulation was provided on the perimeter of the slab, set vertically with the upper edge flush with the top of the slab. Depth of concrete over the floor coils is 4 in. in most locations.

Wall and ceiling radiant panels, consisting of 3/8 in. copper tube embedded in plaster, are used in most of those spaces where it was found necessary to supplement the floor coils with additional heating surface.

Considerable care was taken to equalize length of run in all the coils in each zone. Returns were reversed; coil balancing fittings were also provided, but it turned out that very little use had to be made of them. All coils in each zone are connected to a single overhead air venting chamber.

Steam heated baseboard radiation is employed in corridors and other spaces having large areas of exposed glass. Domestic science and manual training areas and all the classrooms were provided with unit ventilators having steam heating elements.

Steam at 40 psig is required for the towel driers in the serving rooms adjoining the dining areas in the cottages. Piping for this service and for the unit ventilators and direct radiation is installed in tile conduit under the floors, from the pipe tunnel. Separate roof ventilators exhaust air from the toilets, serving rooms, and classrooms.

Outdoor influence predominates in the control of the radiant heating system for the children's units. Steam is admitted to the central hot water convertors under control of an immersion thermostat which is reset by an outdoor compensator to produce a sliding scale of water temperature in the radiant heating supply mains running from about 125 F at zero F outdoors to 80 F at 65 F outdoors.

For each of the zones, controls include an outdoor thermostat, two averaging indoor thermostats, and a manual "warmer-cooler" control in the corridor. All these instruments operate to position the zone mixing valve and are remote adjusting except for the manual "warmer-cooler" switch, which has only a limited influence.

Radiant heating controls are electronic-pneumatic, their sensing elements being electronic and their power elements pneumatic. A pneumatic-electric switch for each zone stops the pump when the associated three-way mixing valve assumes a full bypass position. The main pumps are turned on automatically when the outdoor temperature falls to 60 F and operate continuously until outdoor temperature rises to 65 F.

The engineer's house is radiantly heated by an entirely separate system. Convertor and circulator are located in the boiler room in the main building; the hot water heating supply and return lines run underground within precast sectional concrete conduit. Control is similar to that for the children's units, but operates a valve admitting steam to the convertor with a safety temperature controller to stop the pump upon rise of hot water supply temperature above a safe level.

The auxiliary school has recessed convectors for general heating, and unit ventilators in classrooms. All heating elements are supplied with steam. General convector heating is zone-controlled by exposure, and unit ventilators are controlled from the space. Roof ventilators are employed for classroom, toilet, and special exhaust. Condensate is returned to the boiler plant by means of duplex condensate pumps.

Cost Figures Prove Economy

Ordinarily, it might be expected that the first cost for this free use of a variety of heating media would be higher than normal—no matter how logical the choice of each system for its own application. That this was not the case is borne out by the following cost figures:

Item	General cost	Heating cost	Heating cost as percentage of general
Main project	$5,111,940	$475,125	15.5
Auxiliary school	389,797	33,472	8.6
Entire project	5,501,737	508,595	14.5

This is especially notable when it is recalled that the heating for the main building included the cost of the central equipment furnishing heat to the school as well. As was stated earlier, the boiler plant was sized to handle all the loads likely to be imposed by future construction.

The factors operating to produce these economies, so far as design goes, include holding excavation to a practicable minimum, use of underslab insulation (and also, wall insulation behind wall radiant coils, and roof insulation generally), and central location of the boiler plant with short distribution lines. Use of radiant heating for the children's units reduced the amount of excavation required and thus cut general construction costs. In addition to these basic architectural and engineering decisions, the attempt was made to maintain simplicity and directness in execution of the design. Finally, much is owed to the quality of the general construction and the mechanical installation.

Maginnis & Walsh & Kennedy were the architects for the entire project. The heating and ventilation systems were designed by Slocum and Fuller, consulting engineers. J. C. Higgins Co. was the heating and ventilating contractor. The heating system for the auxiliary school was installed by J. J. Hurley & Co., Inc.

Photos courtesy Bell & Gossett Co.

LSU's New Orleans Campus To Have Outdoor Central Cooling-Heating Plant

A "first" for university installations

● To take full economic advantage of a nonfreezing climate and in keeping with modern design techniques, the master plan for LSU's New Orleans campus, not yet under construction, calls for an outdoor central heating and cooling plant located for future university expansion. With all equipment weatherproofed, the facility will be controlled from a two-story central control tower, the only enclosed structure in the installation.

Mr. Moses, a mechanical engineering graduate from Tulane University, is a partner in the firm bearing his name. His partner, W. David de Laureal, is an engineering graduate of LSU.

BY WARREN G. MOSES
de Laureal & Moses
Consulting Engineers

AN OUTDOOR circular central air conditioning and heating plant with a central control tower located behind a perforated masonry wall and placed in the center of a reflecting pool will be one of the novel features of Louisiana State University in New Orleans.

This is believed to be the first time a complete university campus will be provided with chilled water and high temperature hot water from a central outdoor plant.

LSU has been directed by the state legislature to establish a branch in New Orleans and was granted a 178 acre campus area bordering Lake Ponchartrain on the northern border of the city.

When it was realized that the estimated enrollment for the institution within 10 years would be in excess of 10,000 students and in 20 years approximately 15,000, the need for a carefully considered master plan was ascertained. With the entire project planned at one time to be built from a bare site, the choice of systems became a series of comparisons of initial costs, operating economies, maintenance, ease of adding increments for future growth, and utilitarianism — all with a careful eye on aesthetic appeal.

The consulting engineers' experience in industrial plant work in the Gulf States area indicated very clearly that an outdoor type of central plant would provide major economies for LSUNO. New Orleans' moderate climate has very rare and extremely brief sub-freezing weather.

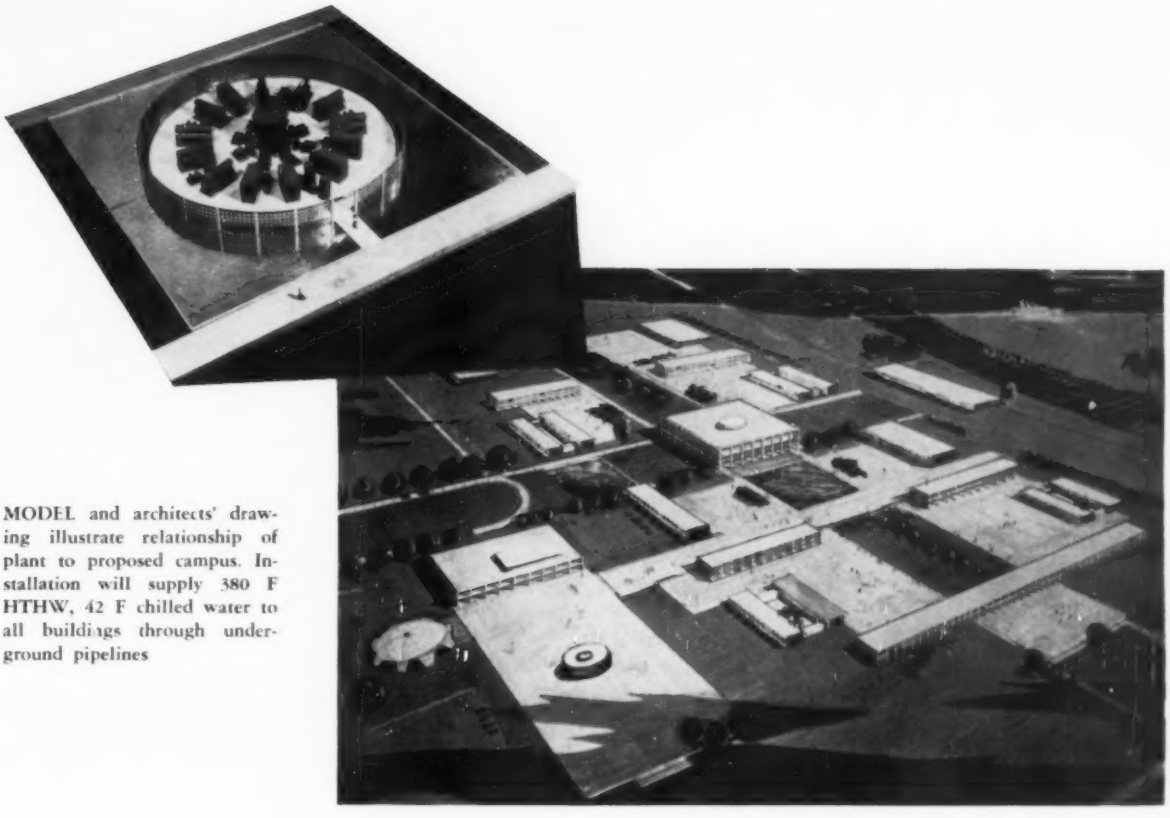
A major factor in the decision was the obvious fact that the university would be built up over a period of years and the central plant capacity would probably consist of many increments to achieve its potential 4000 ton cooling capacity.

Studies Support Gas Firing

The need for a central plant was indicated very early. The economic study also showed clearly that, under present local utility rate structures, gas generated refrigeration would offer economies over electrically powered equipment. So, after intense studies and many economic comparisons, a natural gas fired high temperature hot water plant was decided upon, generating refrigeration through absorption units.

From the central plant HTHW at 380 F and chilled water at 42 F will be pumped through underground pipelines to all buildings, at the desire of the operating engineer.

The hot water will serve additionally as a source for generating local domestic hot water through heat exchangers, and for heating or reheat control of controlled humidity systems. The practically flat terrain and



MODEL and architects' drawing illustrate relationship of plant to proposed campus. Installation will supply 380 F HTHW, 42 F chilled water to all buildings through underground pipelines

the inherently good corrosion resisting qualities of HTHW made it desirable.

One Operator to Control Plant

Another unusual feature of the central plant will be the two story, glass enclosed, airport type tower which will serve as a central control station for the entire campus and afford a single operator an unobstructed view of the plant. From this vantage point, in full view of all items of equipment, the operator will be able to start, stop, and automatically control all equipment; fire boilers; energize pumping systems to deliver hot and chilled water to remote buildings; control lighting systems for remote buildings, parking areas, and streets; supervise maintenance; and perform buildings and grounds protection services. The facility will also serve as a central fire alarm and communications center.

A graphic control panel with a console built around the outer perimeter will enable the operator to read temperatures and pressures and, by pilot lights, retain control of many remote building systems. Temperature controls of remote buildings will not be regulated from the central plant, but actual starting and stopping of all systems will be accomplished from this point.

The circular shape of the equipment arrangement was determined from actual layouts, including the building of a model. This plan was compared to rectangular, ell-shaped, and other more conventional arrangements. With the outer perimeter kept clear for access, tube pulling, moving in equipment, and other operations, the piping system around the inner perimeter is confined to a small area.

The perforated masonry wall is strictly for aesthetics, but the surrounding reflecting pool serves a useful purpose in keeping curiosity seekers away. For emergency repairs, a light plastic awning can be suspended at any point between the masonry wall and the control tower to serve as a rain shield.

The plant will represent an expenditure of about $1.5 million. With the elimination of a building to enclose it, savings of roughly $150,000 will be accomplished. The ease of adding new pieces of equipment as the plant grows is obvious.

Manufacturers of all proposed items of equipment were contacted and they confirmed that their equipment could be readily weatherproofed, easily maintained, and remotely controlled. Use of natural gas fuel and forced draft boilers eliminated stacks. Availability of well water for condensing use obviated the need for cooling towers.

Although LSUNO is now in its first year of operation (present occupancy is in renovated abandoned military buildings on the site), no actual construction on the new campus has begun. It is expected that Phase I, which is about one-third of the projected construction, will be ready by the fall of 1960.

Curtis & Davis are architects for the master plan. The consulting engineers are de Laureal & Moses. ≠

How to Design Refrigerant Piping

● In addition to the generally accepted good practices in pressure piping design and installation, refrigerant piping systems have certain operating characteristics that demand special consideration. The refrigerants themselves are often toxic and sometimes explosive; they undergo various physical changes in completion of their cycles; and they flow at lower than normal temperatures. The 10 rules on the next page are therefore "musts" in the successful design and fabrication of these systems.

Mr. Smith received his BS in mechanical engineering from Virginia Polytechnic Institute in 1949. After graduation he joined Worthington Corp., serving in its air conditioning and refrigeration research and development laboratory. He was awarded his masters degree in engineering at Stevens Institute in 1957. A licensed professional engineer in New Jersey, he is an instructor of special courses at Newark College of Engineering. For the past seven years he has been a product engineer in Worthington's central station engineering department, working on special petrochemical and low temperature refrigeration systems.

BY W. C. SMITH
Product Engineer
Air Conditioning & Refrigeration Div.
Worthington Corp.

REFRIGERANT PIPING SYSTEMS are closed circuits which contain volatile fluids. Some of these fluids are quite costly; some are toxic; and some, when mixed with air, are even explosive. Refrigerant loss from a system would certainly defeat the purpose for which the installation was intended. In fact, in some systems, sudden loss could endanger life and limb.

Refrigeration systems are subject to the effects of mechanical, thermal, pressure, and chemical influences. They have certain inherent characteristics which require special consideration so far as design and erection of interconnecting piping are concerned. First, they involve unique equipment (as opposed to other pressure piping systems). Second, the refrigerant undergoes variable physical phases in its cycle. Third, the low temperatures often encountered differ in varying degree from the usual cases of pressure piping.

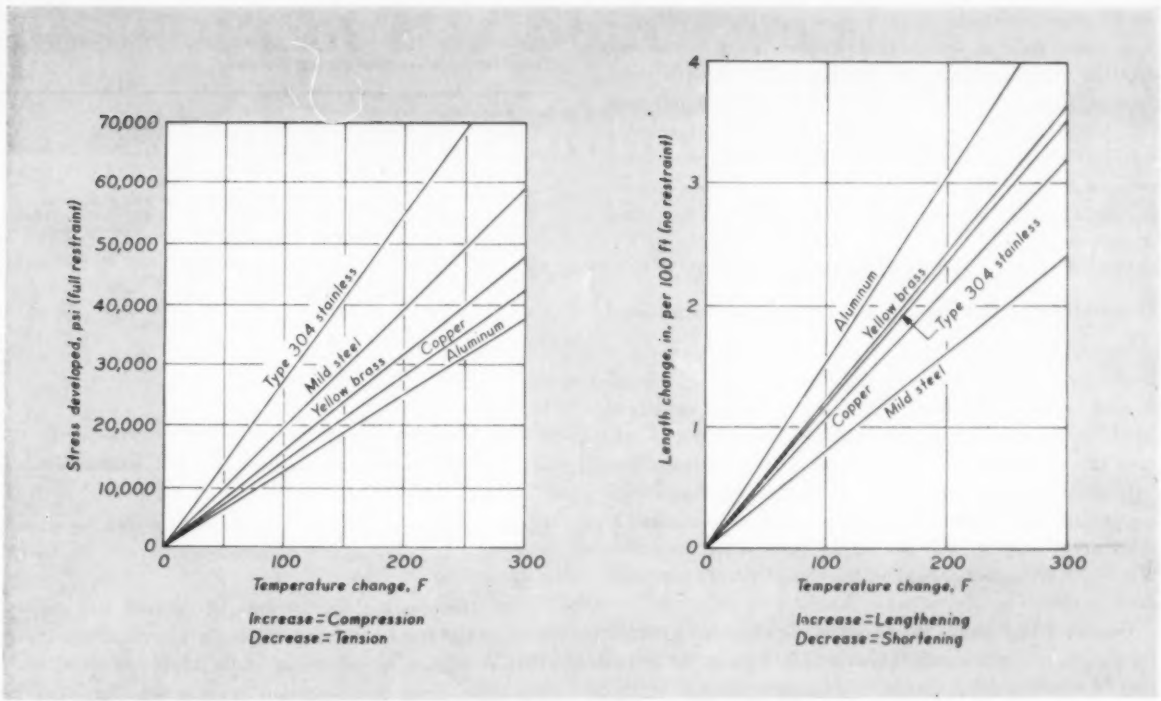
This article deals specifically with refrigerant piping. Brine, water, lubricating oil, and pneumatic instrumentation piping are also associated with refrigeration systems, but can be treated in the normal sense. Necessary precautions must, however, be taken to avoid damage from thermal contraction due to low temperatures, and excessive vibration due to dynamic components such as compressors and pumps. The thoughts expressed here should be considered as additions to, rather than replacement of, the generally understood good practices in the design and fabrication of piping systems.

Classify Refrigerant Piping Several Ways

Refrigerant piping may be classified in several ways. Each suggests some *specific* requirements for the system. Likewise, there are some important *general* requirements. All of these must be considered for each application before the equipment is placed in operation.

Before investing in the design or fabrication of refrigeration piping, local building and safety codes should be investigated to learn whether or not they include applicable provisions or requirements. Local codes might consider this subject under pressure piping in general, or refrigeration in particular. But, in any case, all provisions of any code which might pertain to the project in question must be noted to avoid expensive and time consuming difficulties, and possible litigation at later dates. These codes are generally restrictive rather than inclusive in nature.

Most process, chemical, and petrochemical plants have standard piping specifications which they have devised for their particular uses. These are often imposed on the refrigerant piping contractor. Where there is no conflict with good refrigerant piping practice, the general specifi-



FREE CHANGE in length per 100 ft of common pipe materials with respect to temperature differences shown here. Also indicated are direct stresses which might be generated if the pipe subjected to temperature change were not allowed to change in length

cation may be adhered to. Where conflicts do occur, the ultimate user should be advised of the differences and given the reasons for them. The owner's decision is the final one, but one could not consider him responsible for any future conflicts if all the possibilities have not been explained.

Any particular installation might involve circumstances where generalized rules do not apply. An experienced understanding of refrigeration cycles, applications, and equipment is extremely valuable to one who must design, install, or service refrigeration systems.

Observe These 10 Rules

1) Select materials compatible with refrigerants.
2) Specify proper design temperatures and pressures.
3) Consider all applicable codes.
4) Do everything possible to avoid refrigerant leaks.
5) Mating flanges must mate. Check to be sure.
6) Keep piping absolutely clean.
7) Use proper and sufficient supports.
8) Consider thermal contraction and associated stresses.
9) Consult qualified people for system design.
10) Apply sufficient insulation where required and seal completely against moisture penetration.

Generally, refrigeration equipment manufacturers consider the piping design and installations very carefully when they are asked to appraise a claim for faulty equipment, damaged components, or failure to meet specified performance. Indeed, some manufacturers sell their equipment only on an "equipment only" basis so that the purchaser takes the full responsibility for the application and performance of the components in the completed system. In the more complex systems, such as multiple, compound, or cascade compression types, the component supplier might reserve the right to approve the piping arrangement drawings, or the installed system prior to accepting responsibility for performance or the safe operation of his equipment. The reasons are real and justified, but beyond the present scope.

The most commonly used refrigerants today are ammonia, the halocarbons, and the hydrocarbons. Sulfur dioxide, methylene chloride, and carbon dioxide represent a very small fraction of new installations.

Select Piping for Ammonia with Caution

Ammonia is toxic and its use requires a high degree of caution. Its odor, even in the smallest concentrations, is highly objectionable to say the least and therefore leaks do not go unnoticed if personnel are about.

Black iron or steel pipe (not galvanized) is used for ammonia lines. It is often practical to use small aluminum tubing for instrumentation lines where continuity of line without connecting joints and odd bends is desired.

Small diameter steel tubing may also be used, although it is more difficult to bend when cold. Steel is less susceptible than aluminum to breakage due to vibration fatigue. Copper or copper bearing alloys are never used for ammonia piping. Although anhydrous (perfectly water free) ammonia does not attack copper, the presence of a slight amount of moisture, not too uncommon in an ammonia system, will cause serious and rapid corrosion.

Some Refrigerant Piping Leaks May Go Unnoticed

Halocarbon and hydrocarbon refrigerants are generally heavier than air and often have little or no odor. Unless continuously checked, leaks may go unnoticed until considerable loss of refrigerant affects system performance.

General practice with these refrigerants is often to use copper tubing in sizes below 3 in. and, for reasons of economy, to use steel in the larger sizes. Aluminum containing any magnesium alloying is not suitable for halocarbon lines.

Government Type L hard temper (heavy hard) copper tubing is recommended for soldered piping. Although standard hard tubing is suitable for most common refrigerant pressures, the heavier tubing will withstand much more mechanical abuse, easily justifying its somewhat greater cost. The American Standard Code for Pressure Piping will allow soft copper tubing only for 7/8 in. OD lines and smaller.

Standard wall steel pipe is suitable for pressures up to and including 300 psi. Extra strong pipe is used for liquid lines which are 1½ in. or smaller. Since the piping and pipe connections on refrigeration apparatus are often subjected to unintentional external stresses, it is sometimes considered desirable to go to double extra strong pipe for the smaller lines. Don't overlook the fact that the inside diameter takes quite a reduction when going double strong, especially in the smaller sizes.

Porous Materials Are Unsuitable

Cast materials such as iron and bronze are sometimes unsuitable for refrigerant piping, valves, or fittings due to their tendency to be porous.

Wrought copper or brass fittings are not available in large sizes (above 4⅛ in. ODT). It is then necessary, if steel cannot be used, to resort to cast brass. Any cast fitting should be tested under pressure by the manufacturer prior to installation. Tested fittings are available at refrigeration supply houses. Ordinary plumbing fittings are not suitable. If a fitting is found to be porous after installation, it might be saved by thoroughly tinning the external surface while the system is under a vacuum. This is an expensive alternative to effective testing beforehand.

Plastic pipe has not as yet acquired any significant place in the field of refrigeration piping. However, it might be expected, with new strength increasing developments and advances in techniques of joining and producing plastic pipe, that it may become of economic importance in the future.

TABLE 1 — LOW TEMPERATURE limitations for various piping materials listed, with appropriate comments governing their use in refrigerant piping systems

Low temperature limit, F	Material and suitable ASTM designation	Comments
Zero	Mild steel (A-135, A-53)	No requirements other than suitable pressure rating.
−20	Mild steel (A-53, A-135)	Reduce pressure rating 1 percent for each F deg below zero, or Charpy impact test, 15 ft-lb at design temperature.
−50	Killed or limited carbon steel (A-333, GR-C)	Charpy impact test, 15 ft-lb at design temperature.
−150	3½ percent Ni-steel (A-333, GR-3)	Charpy impact test, 15 ft-lb at design temperature.
−325	Austenitic stainless steel (Types 304, 316, etc.)	Limited carbon content.
No Limit	Nonferrous copper, brass, aluminum	Aluminum, copper, brass. Check chemical compatibility with refrigerant.

The compression refrigerants of present use do not require the use of stainless steels for chemical resistance. This resistance to corrosion is therefore necessary only for some types of absorption systems and for locations where extreme atmospheric corrosion conditions might demand some external protection. Stainless steel is not completely ignored as a refrigeration piping material, however. Its mechanical impact strength at extremely low temperatures makes it valuable for systems producing refrigeration at temperatures below −150 F.

Materials Have Low Temperature Limitations

Ordinary carbon steel becomes brittle, losing its impact strength at low temperatures. Low temperature lines are always covered with thermal insulation which incidentally helps to protect them from external impact blows. This, however, is not sufficient insurance against the type of damage that could result if a pipe should break. The ASA B31.5 1955 Code for Pressure Piping Section 5, requires an increase of 2 percent in design pressure, based on a safety factor of 4, for each degree below zero for ferrous piping. This code also specifies −100 F as the lowest application limit of non-alloyed ferrous pipe, irrespective of design pressure.

Table 1 indicates the low temperature limitations for various piping materials. Low alloy steels may be used below zero when they have Charpy impact values of at least 15 ft-lb certified by test at the lowest design temperature. Austenitic stainless steels with a limited carbon content, copper and copper alloys, and aluminum do not experience transitions in impact strength below ambient temperatures and therefore may be used for low temperatures without pressure rating penalties.

The two primary considerations in joining refrigerant piping are tightness and strength. How to achieve these will be detailed in another article which will appear in an early issue. ≠

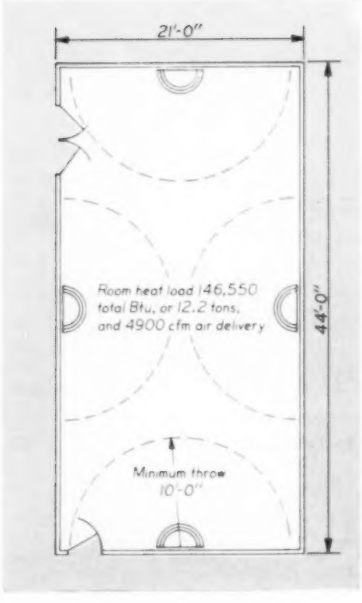
Missile Plant Has Both Packaged Units and Built-up Systems

. . . to serve needs of different processes

● The air conditioning needs of different areas in this missile manufacturing plant—varying in tolerances of temperature and humidity, air cleanliness, and cooling load—paved the way for installation of 430 tons of air conditioning installed as both packaged units and in built-up systems. Packaged units, modified as necessary, are used wherever their advantages are not outweighed by those of the built-up type of installation. Areas with widely fluctuating loads, distribution and humidity control problems, and other conditions are served by systems using radial type compressors and water cooled condensers combined with fan-coil units.

The author is a graduate mechanical engineer from Detroit Institute of Technology. He has an extensive background in many phases of plant engineering and played an important role in the design of the air conditioning installation described in this article. He is a registered mechanical engineer in the State of Michigan.

BY JOSEPH N. SABATINI
Plant Engineer
Missile Div.
Chrysler Corp.



◀ **THIS ROOM requires 5.3 cfm of air per sq ft. Only diffuser selection possible was half-round ceiling units located along walls**

MISSILE MANUFACTURING presents challenging problems to the air conditioning engineer and to the air conditioning industry as a whole. The problems, although not unique, are uncommon. The industry should give particular attention to them because they may be precedent ones which will become typical in process air conditioning in various manufacturing industries.

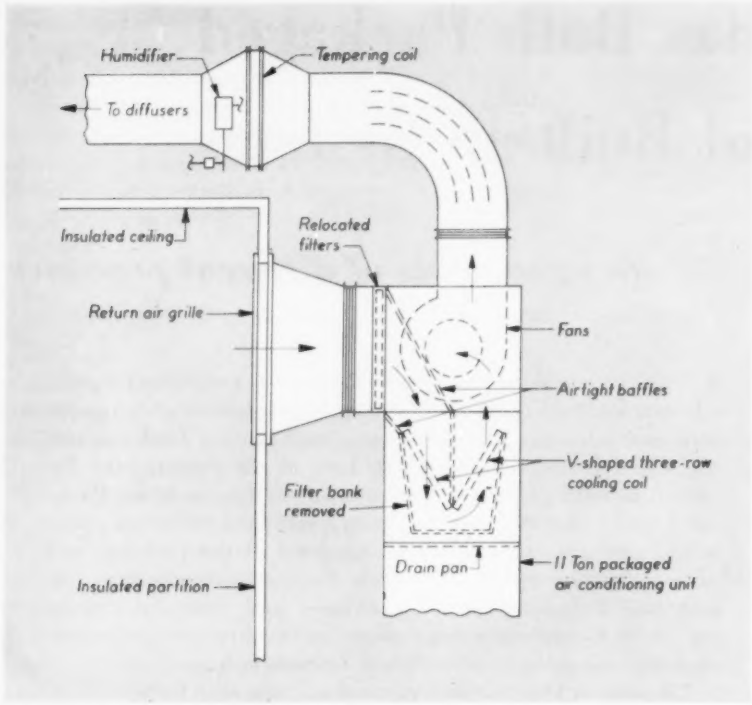
Some of these problems were manifested in a Chrysler Corp. Missile Div. plant. Numerous areas require air conditioning. Approximately 430 tons of cooling was installed in 26 areas. Nearly all of the areas are enclosed with standard 10 ft high insulated partitions and ceilings.

Design requirements of many of the areas included close tolerances of temperature and humidity and air filtering, with capacities of units ranging from 3 to 65 tons. Packaged air conditioners are used in some areas; built-up systems in others.

In designing air conditioning for these areas, probably the most critical problem was the selection of the type of cooling equipment. Although other systems afforded lower initial cost, built-up systems were selected for many areas because they provide a number of important advantages:

First, a frequent problem in this installation was air distribution. Extremely high sensible heat loads are the rule rather than the exception. These loads require volumes in most areas that exceed 5 cfm per sq ft. In one instance they reach a high of 22 cfm per sq ft.

High volumes made the selection of diffusers or registers difficult. Often, in the selection of diffusers, many catalog ratings were examined



THIS PACKAGED UNIT has been modified to maintain 40 percent RH. Leaving WB had to be 46 F; room DB was 68 F; total heat load was 4.1 tons. Three suction valves were removed from five-cylinder compressor, expansion seat was changed, fan volume was reduced to 2400 cfm, and baffles were installed to place the two three-row cooling coils in series

to select a pattern of units with the required volumes and proper throws. Various styles were chosen.

In a number of areas, linear type diffusers were the only solution. In another, the use of half-round ceiling type units, located along the walls, was the only selection. Fortunately, in three other areas the room ceiling was higher than 10 ft. This helped solve this problem.

These large volumes must be distributed at very low neck velocities and short throws. Built-up systems were chosen because they could provide low dry bulb and wet bulb leaving air temperatures. This reduced the high volumes somewhat.

Require Low Leaving Wet Bulbs

Another problem was humidity control in small areas. Many of the areas require leaving wet bulb temperatures of approximately 50 F, with some areas needing even lower leaving wet bulbs. The ability of built-up systems to meet these design points further substantiated their selection.

In a few instances, packaged units were modified to meet design conditions. This modification consisted of removing compressor suction valves to reduce the compressor capacity, reducing the expansion valve capacity by changing its seat, and reducing the amount of air volume by decreasing the fan speed.

The revised compressor-to-coil ratio reduced the coil temperature and, combined with lower coil air velocities, resulted in lower leaving wet bulb temperatures. This was possible when the unit had considerably greater rated capacity than the area load required.

Meet Capacity Control Problem

Another design problem was the fact that the cooling loads in many areas are not constant. There are periods when the conditioned room loads are very low, requiring operation at only a small percentage of capacity. Built-up units, it was found, could be staged with solenoid valves and also have an advantage of providing capacity control. Hot gas bypasses were installed on a few packaged air conditioning units to vary the capacity with the load. But, as a rule, this was done merely as a remedy for existing operating difficulties.

Exhaust Equipment Load

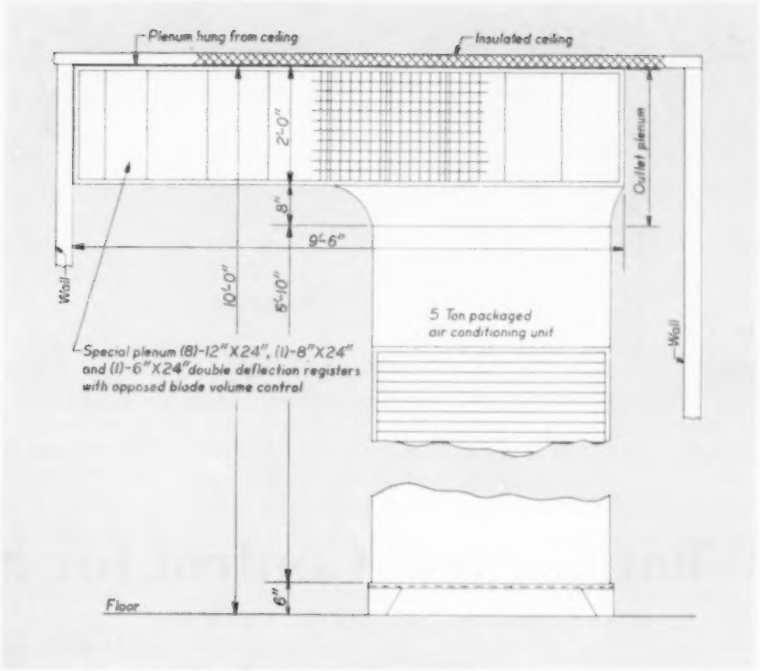
Concentration of hot air caused by high heat producing equipment at various points throughout the air conditioned area was another design problem. Maintaining close tolerances under these circumstances was impossible. The approach to correct this was to locate exhaust hoods immediately over the equipment to remove the hot air before it could circulate through the conditioned space.

Normally, a quantity of air is exhausted from the conditioned area to provide relief for the introduction of a minimum of ventilation air. The advantage is that these high temperatures do not have to be absorbed by the room air and therefore do not cause local undesirable conditions. Although the introduction of outside air to some areas has been increased, the operating costs have been reduced. This is true because the outside air requires as much cooling as the high temperature exhausted from this equipment during only a few days out of the year.

Design for Reliability

Most of the areas presented one or more of the aforementioned problems. In addition, there was another factor that had to be considered —

designing *reliability* into the systems. Missile manufacturing assembly operations are closely tied in with some of these conditioned areas. Consequently, breakdowns must be kept at a minimum. As a means to accomplish this, a daily routine inspection is made of all systems by the plant's air conditioning service group.



ANOTHER MODIFIED PACKAGED unit was installed in area requiring ambient cooling to prevent excessive heat. Heat load was 4.1 tons. Distance to opposite wall was 16 ft. One suction valve was removed from five-cylinder compressor. This permitted reducing air volume from 2000 cfm, and with extended plenum, reduced throw

Modify Packaged Units

Of the 26 areas, three are conditioned by simple packaged units as ordinarily equipped. These areas require ambient cooling only. Two of the three units have specially designed discharge plenums with supply registers to provide enlarged areas. One of these was also modified as previously described to reduce the air volume and throw since the distance to the opposite wall was only 16 ft.

Fourteen of the areas are served by basic packaged units, which have been combined with supply ducts, tempering coils, diffusers, steam type humidifiers, electrostatic air filters, and pneumatic controls. Supply ducts were generally sized at velocities of 800 to 1000 fpm. Tempering coils were selected to give a maximum temperature rise of approximately 20 to 30 F, depending on the cooling coil leaving dry bulb temperature.

Since these areas had only negligible heat loss, the maximum tempering coil outlet temperature selected was 80 to 85 F. This permitted a wide range for the modulating pneumatic steam control valve and closer temperature control.

Coils are single-row with steam distributing inner tubes to reduce the possibility of stratification. They are equipped with automatic air vents, vacuum breakers, and float type traps.

Plant steam pressure is reduced from 30 to 5 psi by a small reducing valve to supply these coils. Steam type humidifiers are located in the supply duct downstream from the tempering coil. This type of humidifier is used because it requires very little maintenance.

Dry type electrostatic air filters with simple water washing manifolds are installed on the makeup air ducts.

In a few of the areas requiring rigid dust control, mechanical type filters were installed on the return air stream. These filters are automatically controlled to continually provide clean media.

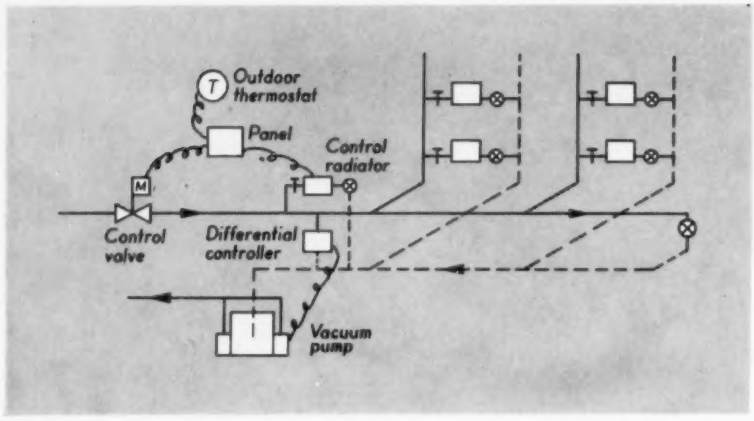
Controls, consisting of sensitive pneumatic thermostats and humidistats, control the compressor motors through pneumatic-electric switches. The humidistats also control the steam humidifiers. The thermostats are directly connected to pneumatically operated steam modulating valves for tempering the air.

The remaining areas are air conditioned by completely built-up systems. Radial type compressors and water cooled condensing units were selected and combined with fan-coil units. The other elements of these units are similar to the previous group.

Radial compressors were selected, when possible, at operating speeds of 1200 rpm because of reliability at this speed. Cooling coil velocities were selected at 350 to 500 fpm to avoid moisture problems and in some instances to permit additional future predicted loads.

The extreme equipment load fluctuations of these remaining areas was the criterion for selecting built-up systems. At no equipment load the remaining cooling load from lights and personnel in some instances would be as low as 10 percent.

Since completion of these installations and after making the normal number of adjustments, the systems have performed very satisfactorily. Temperature and humidity recorders located in the areas with close tolerance requirements indicate satisfactorily controlled conditions. ∓



1 ESSENTIAL ELEMENTS of one type of central control system are shown at left. Other systems are generally similar, but with varying components

What Central Control for Steam Heating Can and Cannot Do

Weigh pros and cons

● Central control for steam heating systems, long a common practice, is being questioned, says the author. Speaking up in defense of this type of control, he takes these questions, one by one, and shows why the central or zone control is desirable as the basic system, and that everything else that is needed depends on the particular job conditions.

Lewis Smith, a Harvard University graduate in electrical engineering, has had many years' experience in the power and heating industries, having concentrated on the sales, servicing, and operation of controls for these systems. He is responsible for the development of heating systems which have been adopted by many apartment house projects in New York City and elsewhere. During World War II he served for a time as chief of the heating section of the War Production Board in Washington. Mr. Smith has authored numerous other articles for Heating, Piping & Air Conditioning.

BY LEWIS SMITH
Heating Engineer

CENTRAL or zone control of steam heating systems has been such a common practice for so many years that it seems odd to read articles or hear talk by intelligent and experienced men claiming that such controls don't work or, at best, do little good.

Perhaps the argument most frequently heard against the use of this type of control to regulate building temperatures goes something like this: "When dealing with their comfort, you can't treat people 'en masse!' You must give each individual what he wants."

There is, of course, an element of truth in this argument, and it can be made to sound very convincing. But actually it doesn't hold water and is based on inadequate

Lack of adequate understanding of capabilities of central control is major cause of controversy

understanding of what central or zone control can or can't do, and just what should be expected of it.

It is again argued that if there are erratic or uncontrollable local heat gains sufficient to require that all heating units be equipped with individual thermostatic controls—as in school houses, for example—then there is no value in having central control as well. This, too, is an argument made without consideration of the benefits to be derived from a central control system, regardless of what else may be done.

Finally, it is often argued that where there is mechanical ventilation in addition to direct heating, any central control would be in conflict with the ventilation control. It can be shown that this is an unsound argument too.

What is meant by the term "central control?" This is described as a motor operated valve at the point where the steam enters the system, controlled by an outdoor thermostat in conjunction with a means to measure the rate of heat output and to govern the operation of the pump, a condensate or vacuum pump and orifice plates or adjustable orifice valves at the inlet to all heating units.

The first thing to do is to look at the building as a whole. The capacities of the heating units are figured in the usual manner, based on some assumed outdoor-indoor temperature difference and a selected wind velocity. This is the capacity required under extreme conditions which occur, at most, only a few times each winter, sometimes not even every winter, and in any case for only a few hours at a time.

The average capacity needed in most localities is only half or less than half of this maximum. Therefore the system has to be shrunk to half its size or less most of the time. That is just what the central system should accomplish. It should keep the size of the system continuously in step with the demand for heat.

But What About Comfort for the Individual?

So far, no attention has been given the individual. The indoor temperature has been selected purely on a mass basis as what the average person needs for comfort. During times when the weather is such as to require the maximum output of the system, all parts of the building are supposed to be at the selected temperature, say 72 F. No occupant can expect to be warmer than that.

If some area does happen to be warmer than 72 F, it is because of sunshine, or heat generated by a stove as in an apartment house, or lighting and overcrowding as may happen in an office building. Unless there has been some miscalculation along the line, or poor construction, or some outdoor air enthusiast insists on opening windows, there should at this time be no underheating.

If the wind velocity is substantially higher than the value used for calculating the heat loss, the temperature of the steam can usually be raised sufficiently by increasing the pressure to take care of this. Thus, the only problem at this time is the elimination of any overheating which may be taking place in some areas.

This can obviously be done by local thermostatic control, but the actual extent of this overheating is so slight that the cost of this additional control is hardly justified. It is only when the weather moderates that control is really needed and it's a one way control—to prevent overheating, not underheating.

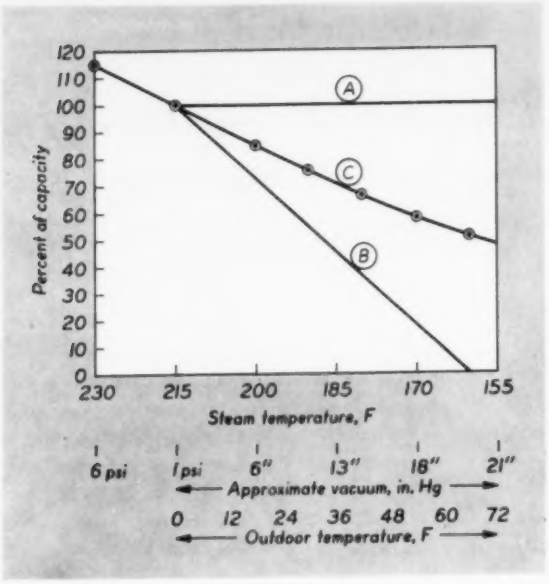
If, for example, a temperature difference of zero outside to 72 F indoors has been taken as the design basis, then, at 36 F outside, the system would still be working at its maximum capacity if by some hocus-pocus the heating units had been cut in two. The building would still be at 72 F and no more, except for those areas where, as before, there would continue to be overheating from local causes.

The object of a central control system is to do this slicing down of the heating units so well that no other control is needed except where individual control is required, as in school buildings, to take care of variations in room demand.

See What Else Is Needed

It should be evident that the first step in designing a heat control system is to treat both the building and its occupants 'en masse' and then see what else is needed. If the building is regular in shape, that is, square or oblong, then zoning for exposure will naturally result in closer control. But the dollar value of the fuel saving often is not enough to justify the extra cost of installation. Most buildings are irregularly shaped and attempts to do proper jobs of zoning often lead to prohibitive expense. Usually it will be found that two zones are about all that can be used to advantage in the average building.

Many people go astray in thinking either (a) that a central control system will maintain uniform temperature in every space all the time or (b) that such a system



2 CONVECTOR CAPACITIES (Curve C) are plotted at various steam capacities as a percentage of rated capacity. Note that capacities lie about halfway between full heat (Line A) and required heat (Line B)

can't do the job at all and might just as well not be installed.

Don't Expect the Impossible

No central system will produce absolutely uniform temperatures in every room in an occupied building every hour of the day. No one should expect such performance. There are far too many things beyond the control of the system which can upset conditions locally. It is, however, true that in an unoccupied building, if it is properly zoned for exposure, the temperature differences in the various parts of the building will be minor and even those will disappear on a still, cloudy day or after dark.

But when a building is occupied, the habits of tenants will upset room temperatures both up and down. In addition, leaky windows can adversely affect the control. Finally, the improper location of furniture and draperies can block off heat and cause unwarranted complaints.

Permit Overheating, If Necessary

In a building having only one control valve, the logical thing to do is to set the control so that the normally cool areas, which usually means the north or northwest side, will be up to temperature and let the rest of the building overheat if it has to. Zoning will, of course, improve this condition. But what is overlooked by many people when such a statement is made is that the extent of overheating will be small, maybe only 2 to 4 F. This would be in only part of the building and only part of the time, so that the waste of fuel is very small. So zoning is one answer. But a considerable improvement can be made, if orifice plates have been used, by changing some of these. This job is very easily done if externally adjustable orifice valves have been installed. By this adjustment the heating effect of any heating unit can be cut down to whatever extent is desired so that rooms which habitually overheat can be brought more into line.

Here, steam has an advantage over hot water. Cutting down the water flow through a radiator by throttling the balancing fitting has much less effect on the heat output because the temperature drop goes up and the heat output is not greatly reduced until close to the shut-off point.

The use of orifices at each radiator valve, or an adjustable orifice valve, depends on the purpose of the system. If it is to control temperatures without further help, then orifices must be used. But if the job requires individual control, like the familiar pneumatic system, then orifices are not needed, although they are desirable for other reasons, provided what is commonly called subatmospheric steam is used.

This system accomplishes its temperature control through circulation of steam at a vacuum, and consequently temperature, varied according to the heat demand. Since steam is not metered through an orifice plate, it will do its job without them if the final control is taken over by other means.

Central Control Eases Individual Control's Task

It would appear from these statements that the central control is no longer essential. In a sense it isn't. But on analysis it will be found that this central control is still doing at least 50 percent of the temperature control job and makes the individual control have a much easier time of it so that it can do a better job.

It isn't necessary to circulate steam at any more than 20 in. Hg. This can be done in practically any system without trouble if a tightness test has been run during installation. From an inspection of the curves in Fig. 2,

Benefits to the owner:

"First, with the heating effect of the convectors reduced, there is much less tendency for the pneumatic control to hunt.

"Second, all the heating surface is controlled."

it will be seen that, at about 20 in. vacuum, the capacity of a convector has dropped 50 percent.

To show this graphically, Curve B has been used to indicate the percentage of full heat required for each outdoor temperature from zero to 66 F. Curve C, which is the convector capacity, lies about halfway between full heat, Line A, and required heat, Line B. The average vacuum would, of course, be about 10 in. Hg.

Since these figures refer to vacuum in the convectors ahead of the trap, it will be understood that more vacuum must be maintained in the return line to insure circulation. This is usually about 1 to 2 in. Hg more.

Longer Life, More Complete Control

Now, here are some benefits which will accrue to the owner from all this:

First, with the heating effect of the convectors reduced 50 percent, there is much less tendency or reason for the pneumatic control to hunt. That is to say, the pneumatic control will work only half as hard and, consequently, do a much better job with longer life.

Second, all the heating surface is controlled. This includes not only all heating units, but all piping as well. That piping can be quite an item. With pneumatic systems it is quite common practice not to control all heating units, such as in bathrooms and kitchens in apartment houses, toilets and corridors in schools, etc., but the central control will include all of these—at least to the extent of 50 percent and, with proper orificing, well towards 100 percent.

In buildings air conditioned with water as the cooling and heating medium, the heat transfer surface, in whatever form it is used, is oversize for the heating cycle. This makes the value of central control greater than ever. Frequently, these systems have complete individual thermostatic control. It is then argued that central or zone controls are a waste of money—a good deal like "gilding the lily."

What is overlooked here is that if the temperature and quantity of the water is controlled at the source, in step with the weather, the performance is improved to even a greater extent than already mentioned for a steam system, because of the greatly oversized radiation.

Problem Is Simpler with "Split" Systems

In the case of "split" systems, where radiation along the exterior walls is used to offset the heat loss and centrally located blower units are provided for ventilation and cooling, the problem is exactly the same as already described as far as the direct radiation is concerned. In fact, the problem is simpler because infiltration, which can vary from hour to hour according to the wind direction and velocity, has been eliminated.

The blower units should be controlled in winter for a constant discharge temperature of about 72 F by a duct thermostat, making use of mixing and/or bypass dampers as necessary to accomplish this result. There will be no conflict between the heating and ventilation control. Sometimes the radiation installed is calculated on the basis of heating to 50 or 60 F only, the balance being done by the ventilation systems. Now the blowers must obviously be controlled from the room temperature or by a return air thermostat. In neither case should the central control system be under the influence of inside temperatures that would start a conflict.

The type of central control best suited for a given job is a story by itself, but there is one factor which has recently come into existence which must be carefully taken into account to get a satisfactory working job. This is the common use today of long runs of finned tubing, either in low cabinets or as baseboard. With either intermittent (on-off) control or one using metering orifices, partial heating must take place at all times except when full heat is required.

With finned tubing under windows in long runs of up to 20 ft or more, a very common situation today, the return end begins to cool down and, even in cold weather, from one-quarter to one-half of the total length will be cold. This permits the cold downdrafts from the windows to sink to the floor and results in complaints of cold feet. On the other hand, the hot end is much too hot.

If some tenant comes along and splits the space into two offices, one office may be cold most of the time and the other too hot. This can be partially cured by using two tiers with a return bend so that even when the pipe is only half full of steam, at least the top one will be hot. But a better and less expensive solution is to use subatmospheric steam circulation. By expanding the steam under a vacuum, with the resulting drop in steam temperature, a single tier can be used because it will stay full of steam the whole length until very mild weather is reached when partial filling will no longer cause complaint. For the purpose of balancing steam flow only, orifice plates with large openings and very slight pressure drop can be used.

The gist of all this is: Always use a central control or zone control as the basic system; then see what else is needed for the particular job conditions. ≠

CONTRACTORS hear panelists at MCAA convention discuss architect-consulting engineer-mechanical contractor relationships. Panel was held to seek an answer to the big question:

Who's Responsible for What

. . . in the Design and Installation of Air Conditioning Systems in Big Buildings?

IT IS THE responsibility of the mechanical (heating, piping, and air conditioning) contractor to deliver a finished product in keeping with the quality and character of workmanship intended by the consulting engineer, said Frank A. Player of the Atlanta mechanical contracting firm of Singleton-Player, representing the mechanical contractors on the air conditioning panel at the recent convention of the Mechanical Contractors Association of America in Washington. Panel moderator was A. I. McFarlan, a New York City mechanical contractor.

"In these times of highly competitive bidding, there is always a temptation to take a chance on an inferior product in order to lower our cost and in order to come out on a job that has already been bid too low or to take some short-cut which will render an inferior installation. However, I believe quality workmanship, cooperation of other crafts on the job, and a reasonable attitude in our relations with the architect and engineer representatives on the job will, in the long run, provide a much more worthwhile method of doing business," Mr. Player said.

"Let's consider some practical aspects of achieving these objectives. The stage is set for the success or failure of the job when we first take in hand the drawings and specifications for it. There, the 'tempo' of the job is created for us. Quite frequently, we do not carefully study the provisions of the general and special conditions pertinent to that installation as we should. It is very easy to skip and not consider all the details. This can be very embarrassing some months later when an inspector may point out something we failed to see which can be very costly at that time.

"We must recognize that the engineer's drawings make reasonable allowances for space conditions, but that they are, after all, only diagrammatic. They should not be used for actual field installations. I believe that we have an obligation under our contract—whether required by specifications or not—to prepare larger scale shop drawings well in advance, fitting all mechanical equipment into the assigned areas. At the same time, particular care should be taken to provide adequate clearances for pulling condenser and chiller tubes, changing filters, and servicing equipment.

"We should even go further in following out the air distribution system and the piping for that job by coordinating the installation of that portion of the work with all other crafts. It is also important to spot diffusers accurately on reflected ceiling drawings, coordinating them with lighting fixtures, public address systems, and suspended ceiling pattern.

"If this type of advanced planning is done before any of the slabs are poured, we will then enter the job with confidence in placing the pipe sleeves and inserts accurately. In this way, confusion later on will be minimized. We can use prints from these shop drawings to circulate

among other crafts on the job through the engineer and the general contractor in an effort to get commitments from these other crafts to confine their work to the space designations made on our shop drawings," he suggested.

Choice of Subcontractors Is Major Responsibility

"Another point that I would like to bring up is the responsibility that we should have in the selection of subcontractors. A chain is only as strong as its weakest link. If we are not careful in the selection of our subcontractors, an otherwise beautiful installation can be completely spoiled by sloppy application of duct or pipe insulation, or by a poor temperature control installation, for instance. We should not just accept the low price on these subcontracts without knowing something about the character, quality, and reputation of the subcontractors who will be doing that portion of the job.

"The last point that I want to mention is most important to us as air conditioning contractors. I will call this 'buttoning up the job.' It is absolutely essential that we air conditioning contractors have in our employ some man capable of balancing the system for air distribution and making the controls work on the job. This man should be capable of checking the electrical circuits, including the interlocking system to be sure it is performing perfectly.

"We should look at little details, such as putting nameplates on the controls and control panels, even though they may not be called for in the specifications. I think it is an indication of the type of workmanship which we should be proud to provide. Nameplates for disconnect switches and controls, and identification tags on the principal valves, are very helpful to the owners. By all means, an isometric drawing of the piping system should be furnished which can be mounted on the wall. This can be invaluable to the owner in showing the location of the control valves and other portions of the system. If we would do that and be sure to leave adequate service manuals on the job, this will save us many 'call-backs' and will certainly add a touch of quality and refinement to the character of our work.

" 'Or Equal' Term Places a Burden"

"I would like to direct two ideas to the consulting engineers for their consideration in the preparation of plans and specifications. This term 'or equal,' in applying to mechanical equipment, places a terrific burden upon us in the selection of equipment. In preparing bids, we may know that one item of equipment is not mechanically equal to the specified item. Yet, the vendor of that equipment is publishing prices and distributing them to all the bidders on the job, and we are faced with the problem that, if we do not use it, our competitor down the street probably will. So what do we do? We either use it, knowing fully well that we shouldn't, and take the chance that it may be acceptable later on, or we don't use it, and lose the job.

"I realize, too, that it is also an equal burden from the specifying angle to limit the specifications, but I believe that I am speaking for the MCAA in expressing a certain desire to see a tighter specification. I would like to suggest that the architects and engineers consider specifying not only one named product which may be used in the design, but maybe four, five, or six other products from which the mechanical contractor may choose. That should not tie the job up so that only one manufacturer might feel that he has a lock on it to keep the price up. This keeps competition in it, but yet it also assures us of an equal break in using our conscience and judgment, as well as our knowledge of the business in preparing our bids."

Cites Solution to Bid Shopping

Mr. Player concluded his remarks by suggesting that separate bids be accepted and that the successful mechanical contractor be selected and assigned to the successful general contractor. He urged this solution to prevent bid shopping because the mechanical installation today is becoming a larger part of the job—"often 30 to 40 percent of the entire contract."

Lack of Complaint Calls Are Measure of Success

Speaking for the consulting engineer, Robert A. Urban, consulting engineer in the firm of Byers, Urban, Klug, and Pittenger in Cleveland, said the success of any air conditioning installation depends upon the workmanship of the mechanical contractor and the final adjustment of the system. He said these two elements are the most difficult for the engineer to convey in the plans and specifications.

"It takes more than just good pipefitters and sheet metal men to put together a successful air conditioning installation. The ability at the contractor can always be measured by the number of complaint calls. An installation not thoroughly checked out cannot be hidden for long. Eventually, the lack of attention turns up and complaints begin to come in," he said.

"In the design of the system, the main problem between the architect and consulting engineer today is recognizing that sufficient space for air conditioning must be provided. The cost for a minor change is considerable for a few more inches of duct space or for the equipment room after the contracts have been awarded. Closer coordination in the planning stage, taking into account all requirements, is of course the most effective method.

"The mechanical drawings are diagrammatic in nature, and the mechanical contractor's judgment must be relied upon as far as the details of assembly, placement and hanging of pipes and ducts, and exact location of equipment to take floor space and headroom."

"After the system is installed, tests and final adjustments should proceed effectively. Some contractors feel that once the pieces are assembled, the job is completed. To properly test and adjust each system, each contractor

should have the necessary equipment and qualified personnel to do this," he concluded.

"Select Contractors Who Have Worked Together"

Vincent G. Kling, Philadelphia architect, representing the architects on the panel, opened his remarks by stating that the most important phase in the execution of any of our present day contracts in the design of a building, including the air conditioning system, is selecting a reasonably good team of contractors who have worked together on previous jobs. This is so important in present day construction where the cost for the air conditioning system can be 28 percent of the total building costs. When we select a group of men who are competent in erecting a building and installing the equipment in the same manner as the equipment is selected, the problem will be largely solved, he said.

"One-half of our business today potentially lies in the field of public domain. Automatically we include the clause 'or equal' which must be in the specifications for this work, and automatically we write our requirements so that either a bind bond or check depository system qualifies the man as being able to sign the contract. I don't think this is the qualification system we want. In our firm, we do not hesitate to advise the owner on the qualifications of any contractor based upon his previous performance. I am sure that you feel just as strongly about this method of prequalification of contractors in order to keep the industry sound and moving ahead.

"When we pull a job apart and assign contract responsibilities for the parts of the building to as many as six or eight major contractors, the leadership position which the general contractor had 30 years ago is gone now. I have jobs today where I have the major responsibility of the general contractor in coordinating the work. This is not right. I am not qualified to do it and am not experienced enough in putting a building together to cross check each contractor's work. This is the responsibility of the contractor, not the architect," he said.

"Why Not More Requests for Separate Bids?"

One contractor asked why more architects and engineers do not ask for separate bids on the mechanical installation. Mr. Kling replied that several large firms are doing this more often, and he thinks they are getting a good team.

Another question from this same contractor asked why the "or equal" clause is not replaced with more names of manufacturers and equipment. He said this would help the contractor greatly in preparing his bids. Mr. Kling answered by saying that he agreed that the "or equal" clause is a lazy man's way of writing a specification. He said that, in his firm, they decide what three or four pieces of equipment can do the job equally well, and these products are named in the specifications. Then they ask contractors to bid on the basis of performance, and the invitations are limited. With this tight control of bidders, who are qualified to do the kind of installation wanted, the over-riding control of the general contractor is automatic. He then coordinates and helps in the work of all trades.

It was brought out in the discussion that followed that the mechanical contractor was, in many cases, acting for the general contractor in dealing with the architect and engineer because of the technical nature of the mechanical work. It was felt that the general contractor is not keeping up with all the technical developments sufficiently to retain his position of serving as the overall coordinator on the job. Of course, the quality of the general contractor is a factor in this.

Another question was asked about the consulting engineer being the logical coordinator on the job since he, rather than the general contractor, has created the design.

Mr. Urban concurred, but said that the architect must be sold on allowing the consulting engineer to do more supervision. Most engineering offices are not equipped with sufficient personnel to handle this supervision. He said his firm makes an early visit to the site, one near the mid-point of the job, and a final inspection. However, by the time the final inspection is made, everything is covered up and little can be done to alter anything then.

Should Fees Be Increased?

Another question asked if the architect and engineer should increase their fees to allow for supervision when the general contractor is not qualified to direct the job.

Mr. Kling replied by referring to the early history of organized contracting work in Europe over 200 years ago when the architect was often the supervisor. However, the American method has been a general contractor supervised team. He pointed out that today "a big chunk of the responsibility" in supervision rests with the mechanical contractor to be sure that his part of the job is put in properly. He said the pendulum was swinging back to the architect and consulting engineer to supervise the execution of the contracts because, where cases involving building failures have been tried, it is a big circle as to who made the error. Was it the architect, was it the engineer, or was it the contractor?

The courts are beginning to look toward the architect and engineer to assume the responsibility for overall supervision. He predicted that major ground rules will be changed in this country in the next decade to shift the major responsibility to the architect and engineer.

Mr. Kling stated that the architect and engineer should be given the authority as well as the responsibility. This will produce the finished result. When they do get the authority, they will take the responsibility, he said. Of course, the laws have to change to permit it. This is the way it was 200 years ago, and the best buildings ever produced were built under this system, he said. The architecture of today is not as good as could be done, and the mechanical equipment is not as good as it should be, largely because the leadership position is spread among so many people, concluded Mr. Kling. ≠

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says:

"'Tis Folly To Be *Un*wise"

SOLOMON is said to have prayed for wisdom. Having been granted wisdom, he is recorded as having acquired everything else. "Wisdom" therefore was the key to the success of his every undertaking.

And so it is today. Wisdom — based on a solid engineering background, sound judgment, and thoroughness in covering every job detail — is an essential quality to the consulting engineer. To plagarize Thomas Gray a bit, 'tis folly to be *un*wise — as is evidenced by this brief narrative of the plights of one poor soul whom, I understand, is now out pounding the pavement in search of employment.

1) This engineer didn't make clear which contractor was to install condensation drains for a particular job. Each contractor successfully dodged the responsibility. In the end the engineer paid for the drains.

2) Neither did he specify which was to build causeways over the tops of the insulation on refrigerated air supply ducts in the warm attic of a big building. The insulation was worn off, and the tops of the ducts were well staved-in. The owner was taught to build some protective stiles to help the pig over the stile. But he didn't forgive the engineer.

3) Further, he called for an induced draft cooling tower to transfer to the outdoor air the heat removed from the building. He permitted a contractor to substitute a propeller exhaust fan on a horizontal shaft on this tower, facing the impact of the wind. As a result the tower did not sufficiently cool the condenser air whenever the wind faced against the fan. People entering the front door of the building hunted for umbrellas to shelter them from the artificial rain that was being sprayed out by the fan whirl.

4) He must have failed to add the summer heat-reception to the air within the air conditioned building through the sun heated un-insulated black roof. He did add the heat from the hard working human population; and perhaps he added the heat from the electric lights and electric motors. He knew that the air exhausted for purposes of ventilation and odor control must be replaced with at least an equal volume of outdoor air. He didn't treat this new air to reach the same temperature and moisture condition as the air that was exhausted from the building.

Analysis of this relatively small case developed that the installed cooling capacity was rated at 95 tons. Experience proved that the rating should have been 145 tons. Here was an example of 65 percent wisdom. Hardly enough.

The engineer yielded to the owner's importunities and allowed part of this 95 ton refrigerated ventilating system, for a large place of public assembly, to have direct expansion evaporators in the cooling ducts.

Part of the plant had chilled water cooling coils that were also used with hot water in winter. They were too thick across the air stream for heating and too thin for cooling.

I say cooling coils should be cooling coils exclusively. Likewise, heating coils should be heating coils exclusively. #

Planned Maintenance Pays Off in Minimum Downtime

. . . *in iron ore pelletizing plant*

An elaborate system of records and scheduled inspections of mechanical equipment guarantees an uninterrupted supply of steam at this iron ore processing plant

BY LESTER S. RIES
Consulting Engineer
Formerly Superintendent
Buildings and Grounds
Oberlin College

LESS THAN three days' unscheduled downtime in three years of continuous service at very high operating temperatures and pressures is an excellent testimonial for a preventive maintenance program.

This record of performance belongs to the huge taconite processing plant of the Reserve Mining Co., 55 miles northeast of Duluth. Here, crude taconite is treated and processed as it comes from the mine and emerges as shiny iron ore pellets ready for the steel mills.

This crushing, grinding, magnetic separation, and pelletizing process requires very large quantities of water and power. At present the plant is producing pellets at the rate of 5 million tons annually. About 16,800 gal of water and 90 kwhr of power are required per ton.

Steam for powering a 40,000 kw turbine-generator is supplied by a single boiler with a rated output of 450,000 lb per hr. Operating steam pressure varies from 1250 to 1380 psig with a maximum sustained output of 510,000 lb of steam per hr. This is believed to be one of the highest pressure-temperature steam installations in any industrial plant in the U. S. Heating is also provided by this plant.

Note that this plant has only one steam generator. Management made this decision because of the large in-

"Systematic check is made at regular intervals"

vestment required in providing a comparable standby unit.

Because of the dependence on the single boiler for maintaining the operation of this large enterprise, a thorough and elaborate system of records and inspections is used.

Thorough Annual Checkup

Advantage is taken of the state requirement that the insurance company's inspector thoroughly examine the cold system once every 12 months. During this inspection period, the plant operators accompany the inspector and assist him in making checks and tests.

An audio-gage is used to check on tube and metal wear. All valves are repacked at this time. If any defects are discovered, repairs are made immediately. Safety valves are reseated and reset, and soot blowers inspected and adjusted. Pulverizers are checked for ball size, and grinding rings and burner impellers are inspected and cleaned.

A full written report is made on the condition of each element, including what maintenance was done. This is compared with previous records.

The general foreman is charged with the responsibility of plant maintenance and detection of items requiring adjustment, repair, or replacement. A centralized maintenance and repair organization serving the entire operation is available to the superintendent. From this department he draws requisitions for service.

Request on Man-Hour Basis

Previous to the overhaul period, the superintendent requests and is granted a specific number of hours for the overhaul and adjustment operation. Each job, no matter how small, is tabulated and a definite time allotted for its completion. A person or persons are assigned to do the job.

Each replacement part required is checked to make certain of its availability and the indicated work to be performed is described.

After work has begun, a systematic check on performance is made at regular intervals and compared with the estimated schedule. This careful preparation and performance has resulted in the overhaul job being completed within the allotted time schedule and has developed favorable relations with the operating divisions of the company.

In preparation for the extensive overhaul, details of repair or adjustment requirements are accumulated by carefully noting observed and recorded performance. The superintendent devotes time each day to examine the previous day's records which are assembled in his office. These records and the procedures in analyzing them are:

1) The recording instrument charts are assembled daily, each on its individual peg, on a large board. The charts are studied in conjunction with the operators' daily log and with charts of previous runs. Any irregularities that cannot immediately be reconciled with fluctuation in operational demand are investigated.

2) The several daily log sheets turned in by the operators are reviewed. Operators inspect each piece of equipment hourly, record bearing temperatures, etc., and are encouraged to comment on their log sheets any detail that they feel important.

3) Performance tests are made every six months on every piece of equipment. This includes every gage, every bearing, all auxiliary units, etc. The information is collected and recorded on printed forms. Test sheets are compared year by year with those previously run (at present this would be three years).

4) Performance figures are charted on a heat balance diagram and checked against the original heat balance chart.

Through this testing, recording, and checking, any deviations from the norm are spotted before serious problems arise. Mechanical failures are thereby reduced to a minimum. As a further precaution, all instruments are calibrated frequently.

As an important phase of its maintenance program, the company conducts a school on a four-year apprenticeship for its mechanical, electrical, and instrument repair staffs. ≠

Unique Procedure Minimizes Pulverizer Wear

Let's detail a unique maintenance procedure followed by Reserve Mining with equipment subject to extreme wearing of parts. For example, the three ball pulverizers each use two sets of sixteen 10½ in. balls which are constantly worn down in size in pulverizing coal. Actual wear on the balls depends on the particular coal being fired, but inspection of ball size is based on a wearing of 0.005 in. per 24 hr of operation.

The two sets are periodically alternated, interchanged, and added to until the balls have worn down from their original 10½ in. size to 7 in. diam. In interchanging, the necessary number of balls from the idle set is added to the set in operation to compensate for reduction in ball size.

When all balls have worn to 7 in. diam they are discarded and the procedure gone through all over again with two new sets of balls. By this method the wear on the upper and lower grinding rings is kept to a minimum.

MORE THAN 4000 ft of wrought iron pipe delivers radiant heat to two airport hangars to maintain 55 F (70 F in lobbies) at outside temperatures down to −10 F

Floor Panel Radiant System Solves 5 Heating Problems

. . . *in two airplane hangars*

INSTALLATION of one radiant heating system solved five vital airport hangar heating problems for Lane Air Services Co., Columbus, Ohio.

The system was installed in each of two Lane Memorial hangars to:

1) Restore indoor temperature quickly after the hangar is chilled when main doors are opened

2) Provide a comfortable working temperature for personnel

3) Eliminate ice and snow blocking or jamming main hangar doors

4) Maintain comfortable temperatures in a large reception lobby

5) Help keep hangar floor dry, after ice and snow melt from aircraft, by speeding evaporation of water.

Fabricated of wrought iron pipe coils embedded in 8 in. thick concrete, the radiant heating system has proved its effectiveness many times. Once, during a 22 mph wind at 10 F outside temperature, the central hangar area temperature dropped 22 F when hangar doors were opened. When they were closed, the original indoor temperature was restored in only 6½ min.

The individual radiant heating systems are designed to offset a 5 million Btu per hr heat loss in each hangar. They maintain 55 F in hangars and 70 F in lobbies at outside temperatures down to −10 F. Heat loss from floor to ceiling in the 47 ft high hangars is gradual; comfort is emphasized where it is needed most —near floor level.

Each system is designed with a special loop at hangar doors to prevent them from freezing shut during winter months. Heat in these door areas provides, in effect, a limited snow melting system, since a sufficient amount of heat is provided to prevent snow and ice from collecting just outside the doors.

One of the hangars has a 142 × 120 ft area that includes a lobby, two rest rooms, a boiler room, and 10 shop rooms. Located in a corner of the hangar and subjected to severe wintry blasts, the lobby has doors to the outside on two sides. Conventional warm air heat to this 18 × 10 ft area is supplemented by the radiant panel system. The other hangar has a 172 × 96 ft floor area.

A special ceiling-hung vertical unit heater is in the center of each hangar and is employed basically to de-ice aircraft. Revolving discharge of these units for aircraft de-icing is supplemented by radiant heating which also quickly dries melted ice and snow from the floor.

The pipe was laid on centers varying from 5 to 12 ft in the main hangar area, while 1¼ in. pipes were laid on 24 in. centers in the lobby section. One in. above each length of pipe, and 18 in. wide, the contractor positioned 6 × 6 in., No. 6 mesh in the concrete. Welded joints were used to connect the pipe coils to the 4 in. diam headers.

Solution charging pumps are driven by ¼ hp motors to deliver 42 percent ethylene glycol heating medium from 100 gal tanks into the heat exchangers and the pipe coils. A 1½ hp, 208 volt motor for each system maintains a circulation of 130 gpm into the main headers.

The systems were designed by Ralph J. Kramer, Comer, and Passe, consulting engineers. H. James Holroyd was architect for the hangars. The mechanical (heating, piping, and air conditioning) contractor was the J. A. Myers Co. ≠

New Method Speeds Design Of Pipeline Expansion Loops

. . . aids in checking existing loops for stress

● The author reports that he has found this method of determining expansion loop dimensions to be of considerable value in saving time in pipeline design work. It has also served for checking loop designs of existing systems in order to determine maximum stress involving stress intensification to which welding ells are subjected.

After graduation from the University of Michigan in 1917, Mr. Partch had five years' mechanical design experience at the Ford Motor Co. He was then engaged in power plant and process design at Wyandotte Chemicals Corp. until 1926. After spending a year at The Detroit Edison Co. in piping design, he returned to Wyandotte where he was put in charge of steam production. Next, he went with Giffels and Vallet, consulting engineers, where he specialized in power plant design. Later, after joining Smith, Hinchman & Grylls, Inc., architects and engineers, he authored the article *Calculating Flexibility for Straight Line Piping Elements*, which appeared in the December 1953 issue of Heating, Piping & Air Conditioning.

BY LOUIS E. PARTCH
Mechanical Engineer
Corps of Engineers
U. S. Army

PIPING DESIGNERS are often required to include expansion loops in the plans for long pipelines.

Thirty years ago expansion loops were made up by bending lengths of pipe with radii equal to six pipe diameters into four 90 deg turns. With the introduction of welding fittings and dependable welding practice these expansion loops often became more rectangular in shape. Modern practice often requires the placing of much of this piping in underground conduits where there are limitations as to space available for expansion. Welding ells are most practical for these conditions.

The purpose of this article is to present formulas and charts from which the dimensions of pipeline expansion loops can be determined. This material also serves the purpose of checking existing loops in order to determine the maximum stress involving stress intensification to which the welding ells are subjected.

This article is limited to the problems of rectangular expansion loops located midway between anchor points in a pipeline. The method is based on the assumption that

a neutral axis exists that is parallel to the pipeline. The assumption is also made that the expansion loop is restrained by means of guides, as indicated in Fig. 1, and that the flexibility calculations are confined to the loop members between the guides. The neutral axis passes through the centroid of the loop that is included between the guides. In most cases, the neutral axis is at a greater distance from the top of the loop than from the main pipeline. This larger distance, y, is used to determine the maximum bending moment, Fy, expressed in inch-pounds.

Square corners are considered in order to simplify calculating dimensions. The proportions of the loop are selected which determine the factor C. The amount of expansion to which the loop is subjected in both the hot and cold conditions must be determined. The modulus of elasticity, pipe diameter, and allowable stress due to bending are also necessary.

The height of the loop may be determined from:

$$H^2 = (CE/S)\ \Delta\ D\ i \quad \text{.....[1]}$$

In the design of many expansion loops where similar proportions can be used, the expression CE/S becomes a constant so that H in feet may be read conveniently from a nomogram, such as Fig. 1. This is based on a bending stress value of 14,000 psi, E is 29 million, and C is 0.5. From these figures, CE/S used in this nomogram is 1036 and, for convenience, values of stress intensification, i, are multiplied by the diameters D.

The expansion $\triangle$ is that movement of the pipe through the guide points to which the loop is subjected, both in cold spring and in the hot position, as completely expanded. If cold spring is not made use of, then the loop should be designed for the total expansion.

The American Standard Code for Pressure Piping, ASA B 31.1-1955, 621-d, requires that "Calculations shall take into account stress intensification factors found to arise in components other than plain straight pipe." Such factors may be obtained from a manufacturer's catalog and engineering data book. These have been applied to the nomogram Fig. 1 as a multiplier in the scale D.

How Formula Is Derived

Equation 1 is derived from the basic formulas for the reacting force and stress:

$$F = (\Delta\ E\ I)/K \quad \text{.....[2]}$$

and

$$S = F\ y/Z \quad \text{.....[3]}$$

These were presented in Heating, Piping & Air Conditioning in December 1953 under the title *Calculating Flexibility for Straight Line Piping Elements*. When the members of a loop such as H, W, and G can all be expressed in terms of H, then it is possible to derive a formula and solve for H.

Combining the Equations 2 and 3:

$$S = (\Delta\ E\ I\ y)/(K\ Z)$$

Since $(2\ I/Z) = D$, the expression above is:

$$S = (\Delta\ E\ 2\ I\ y)/(Z\ 2\ K)$$

Nomenclature

The following is the nomenclature used in the equations in this article:

- H = height or length of the offset legs of a loop that are at right angles to the pipeline, in.
- W = width of the loop, in., expressed as a fraction of H.
- G = distance from the guides to the vertical legs, H, expressed as a fraction of W.
- C = dimension factor of the loop that is determined from the ratios W/H and G/W. Values of C are found in Fig. 1.
- Δ = expansion to which the loop is subjected either in prespring at ambient temperature or in the operating condition, in.
- E = modulus of elasticity, psi.
- D = outside diameter of the pipe, in.
- S = bending stress, psi.

The maximum stress is in section W when $G/W > 0.5$. When $G/W = 0.5$, the bending stress in G and W are equal. When $G/W < 0.5$, the maximum stress is along the sections G because of the position of the neutral axis.

- F = reaction due to expansion which acts along the neutral axis, lb.

This is simplified to:

$$S = \Delta\ E\ D\ y/2\ K \quad \text{.....[4]}$$

In Equation 3, y is the greatest distance from the neutral axis to that part of the loop in which the maximum bending moment and stress exists. This y is expressed as a function of H, or $y = f_1 H$. The term K may also be expressed as a function of H, or:

$$K = f_2 H^2 \quad \text{.....[5]}$$

Then the term $Y/2K$ becomes:

$$(f_1 H)/(2 f_2 H^2)$$

or

$$f_1/(2 f_2 H^2)$$

The C numbers appearing on the left hand scale of Fig. 1 are the computed values of the term $f_1/2 f_2$. Thus Equation 4 becomes:

$$S = (C E \Delta D)/H^2$$

Transposing the terms H^2 and S produces:

$$H^2 = (C E \Delta D)/S \quad \text{.....[6]}$$

H is the height of the loop if the stress intensification is unity, as is possible with certain thick wall fittings. If standard welding ells are used, D must be multiplied by the stress intensification factor i, as required in the Code. Equation 6 then becomes Equation 1.

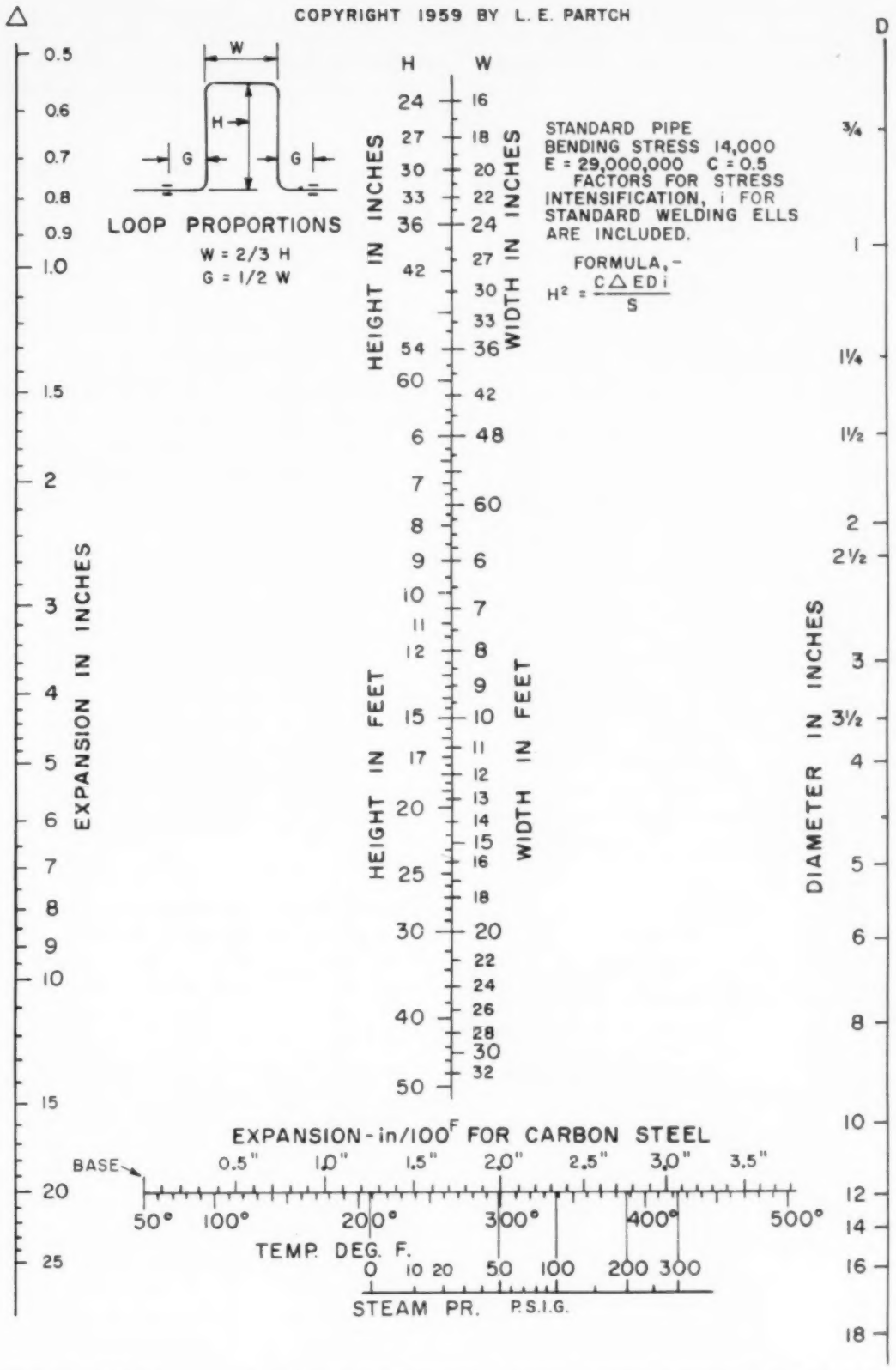
The force that is directed toward the anchors in the hot condition or pulling away from them during cold spring is determined by use of Equations 2 and 5.

Fig. 4 is a chart in which the values of f_2 are given. When H has been determined, K may be calculated from Equation 5.

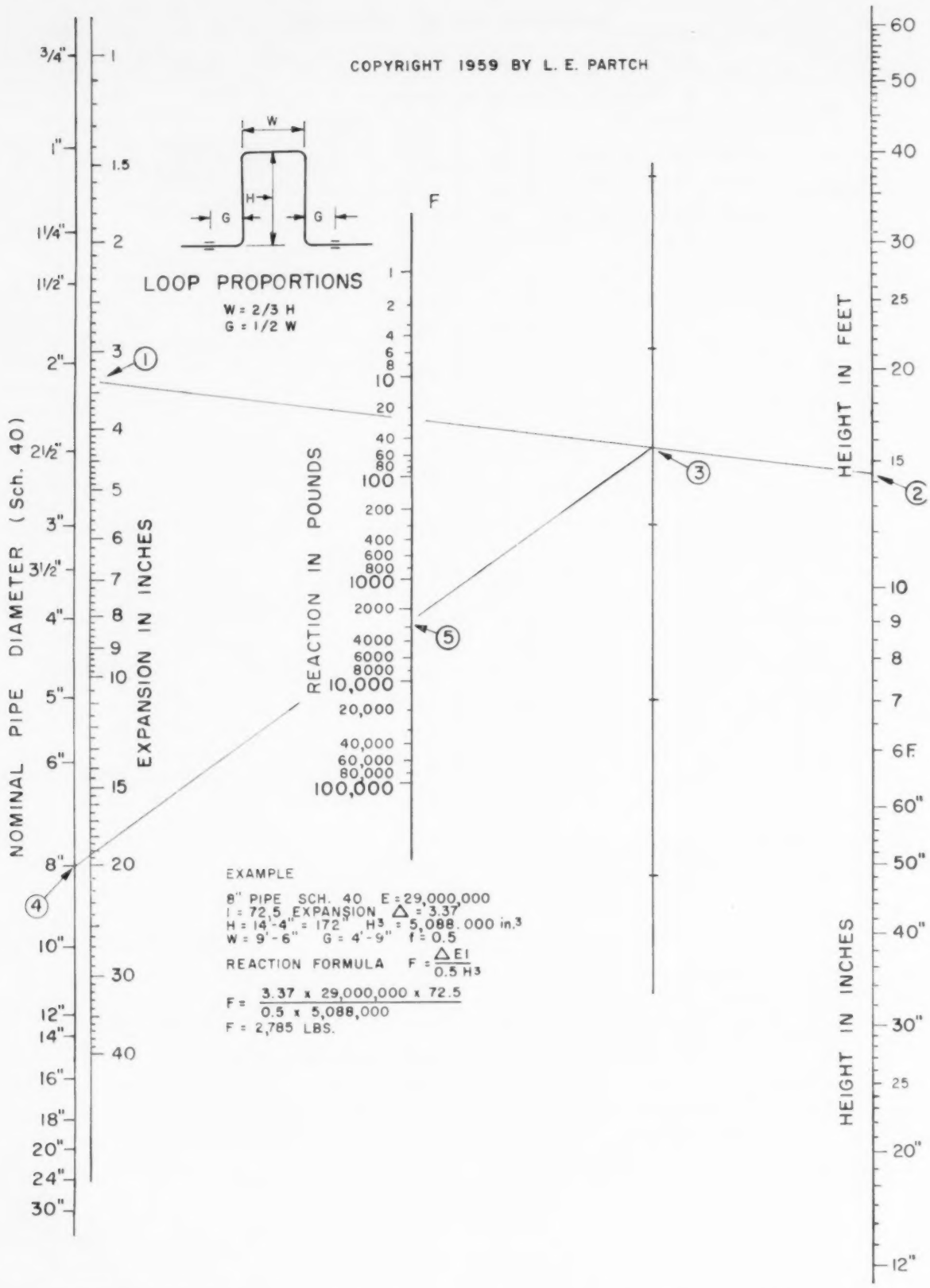
Then

$$F = \Delta\ E\ I/f_2 H^3 \quad \text{.....[7]}$$

For underground loops that are fabricated to a common ratio of $W = 2/3\ H$ and $G = 1/2\ W$, Fig. 2 will serve to determine the force. The value of f_2 used in Fig.



1 SIMPLE NOMOGRAM serves to determine principal dimensions of rectangular expansion loops using welding ells and standard pipe. Temperature and pressure limits are 300 F, 150 psig, respectively



2 THIS TWO-LINE NOMOGRAM can be used for determining anchor reactions of rectangular expansion loops

2 is 0.5. The values of H are determined from Equation 1 or Fig. 1 using these same proportions. It appears from this that the two nomograms are limited to temperatures under 400 F and to fluid pressures under 200 psig, using standard pipe.

• Example 1:

The first example is for an underground pipeline in which steam flows at the rate of 40,000 lb per hr at 140 psig and 360 F. The surrounding soil temperature is 50 F, and the distance between anchors is 350 ft. Cold spring of 50 percent is made use of. The pipe is 8 in. Schedule 40 standard. D = 8625 in.; I = 32.5; and Z = 16.81. The material of the seamless pipe is A 106, Grade B. The allowable stress at 360 F is 15,000 psi. The stress due to pressure is 140 × (50/8.40) = 833 psi. The stress allowed for bending is assumed to be 14,000 psi. Modulus of elasticity is assumed to be 29 million psi.

The shape of the loop is selected in which W is 2/3 H and G is ½ W. The C value for this shape is 0.5. Stress intensification factor for the 8 in. welding ells is 2.42. Expansion per 100 ft is:

zero to 360 deg	2.884 in.
zero to 50 deg	0.367 in.
50 to 360 deg	2.517 in.

Expansion of the 350 ft length is 3.5 × 2.517 = 8.8 in. With 50 percent cold spring, the value of Δ is 4.4 in. Then:

$$H^2 = (0.5 \times 29 \text{ million}/14{,}000) \times 4.4 \times 8.625 \times 2.42 = 1135 \times 91.8 = 95{,}000$$

and

$$H = \sqrt{95{,}000} = 308 \text{ in.} = 25 \text{ ft, } 8 \text{ in.}$$

The force of cold spring is derived using Equation 7. In this example H = 308 in. and H^3 is 29,220,000. From Fig. 4, f_2 is 0.5.

$$F = (4.4 \times 29{,}000{,}000 \times 32.5)/(0.5 \times 29{,}220{,}000) = 284 \text{ lb}$$

The force may be determined from Fig. 2. Both of the nomograms are based on the loop proportions W = 0.66 H and G = 0.5 W. Any other proportions will require calculation by means of the equations as is carried out in these two examples.

• Example 2:

The second example is that of a high pressure steam transmission line conveying 1000 F steam at 400,000 lb per hr at 1200 psia. The pipe size is 8 in. Schedule 80. The allowable stress for Cr - Mo seamless steel A 335 P 11 is 7800 psi. The stress due to steam pressure is 2600 psi. This leaves 5200 psi for the maximum stress in bending. The ambient temperature is 60 F. Thermal expansion is given in the Piping Handbook, by Sabin Crocker, McGraw-Hill Book Co., Inc.

The value of stress intensification, i, is 1.72. Expansion from zero to 1000 F is 8.75 in., and from zero to 60 F is 0.43 in. Then, by difference, from 60 to 1000 F, it is 8.32 in.

The distance between anchor points is 350 ft and the total expansion is 8.32 × 3.50 = 29.12 in. The amount of cold spring may be calculated so that the height as determined from the cold spring factors is the same as that from the hot expansion factors. The terms H, C, D, and i are the same in both cases. Values of S and E are influenced by temperature and pressure. The problem then consists of solving for Δ in both the hot and cold conditions.

Let $\Delta = \Delta_h + \Delta_c$. Then let S_h and S_c represent the allowable stresses. Also let E_h and E_c represent the values of E under the limiting temperatures that may occur. Then, since H^2 is a constant, it may be eliminated by the equation:

$$H^2 = (C\ \Delta_h\ E_h\ D\ i)/S_h = (C\ \Delta_c\ E_c\ E\ i)/S_c$$

$$\Delta_c = (E_h \times S_c)/(E_c \times S_h)\ \Delta = (23 \text{ million} \times 15{,}000)/(30 \text{ million} \times 5200) = 2.212\ \Delta_h$$

$$\Delta_c = 2.212\ \Delta_h \text{ (Since } \Delta_h = \Delta - \Delta_c)$$

$$\Delta_c = 2.212\ (\Delta - \Delta_c)$$

$$1.000\ \Delta_c + 2.212\ \Delta_c = 2.212\ \Delta$$

Then

$$3.212\ \Delta_c = 2.212\ \Delta$$

$$\Delta_c = (2.212/3.212\ \Delta) = 0.689\ \Delta$$

or

$$\Delta_c = 0.689 \times 29.12 \text{ in.} = 20.06 \text{ in.}$$

A general formula for cold spring can be set up by letting the fraction $(E_h \times S_c)/(E_c \times S_h)$ be represented by the number N .....[8]

Then

$$\Delta_c = [N/(1 + N)]\ \Delta \text{ .....[9]}$$

The proportions of the loop selected in this example are W = 2.5 H and G = 0.5 W. From Fig. 3, C = 0.185, and f_2 from Fig. 4 is 1.41. In this case the pipeline and the expansion loop are suspended from structural steel by means of swing hangers so that the loop is free to expand through the guides.

Dimensions are calculated as follows:

$$H^3 = (0.185 \times 20.06 \times 30 \text{ million} \times 8.625 \times 1.72)/15{,}000 = 110{,}000$$

$$H = 332 \text{ in.} = 27 \text{ ft, } 8 \text{ in.}$$

$$H^3 = 36{,}600{,}000 \text{ in.}^3$$

$$W = 2.5\ H = 69 \text{ ft, } 2 \text{ in.}$$

$$G = 0.5\ W = 34 \text{ ft, } 7 \text{ in.}$$

Distance between guides is 138 ft, 4 in.

The force of the cold spring pull on the anchors is $F = \Delta\ E\ I/K$, in which $K = 1.41 \times H^3$, and I = 105.7 K = 51,500,000. Then:

$$F = (20.06 \times 30 \times 105.7)/51.5 = 1277 \text{ lb}$$

The height required in the hot position checks with that calculated from the cold condition:

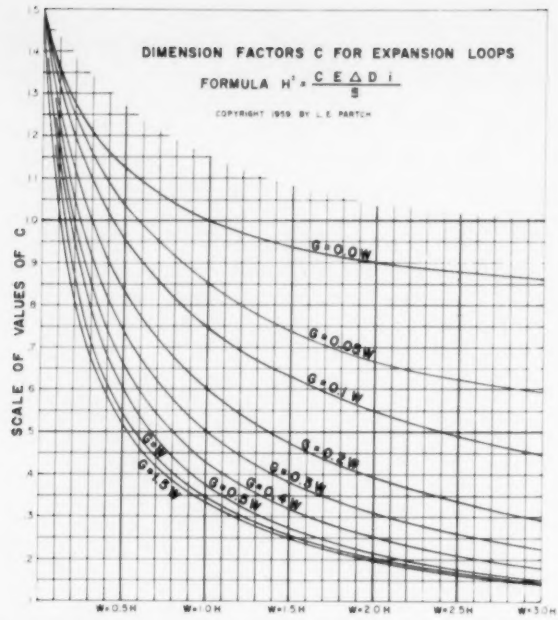
$$H^3 = (0.185 \times 9.06 \times 23 \text{ million} \times 8.625 \times 1.72)/5200 = 110{,}000, \text{ and } H = 332 \text{ in.}$$

The anchor reaction, however, is much less:

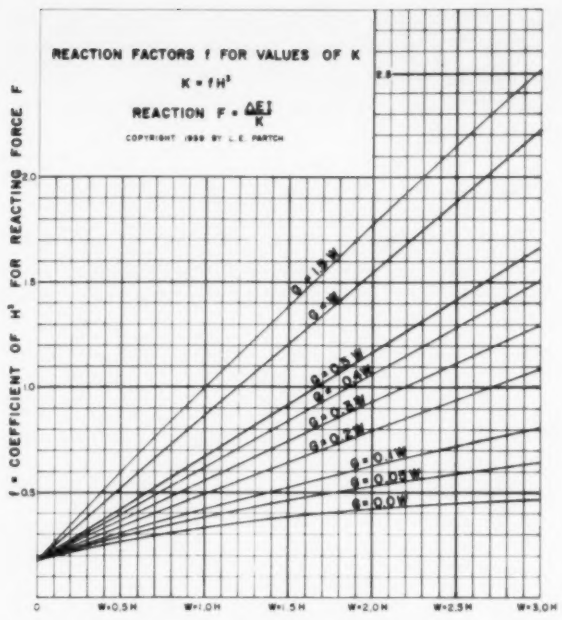
$$F = (9.06 \times 23 \times 105.7)/51.5 = 448 \text{ lb}$$

Identify Special Fittings

It should be possible to make an 8 in. welding ell, for example, in which the stress intensification factor is down to 1.00 instead of 2.42. Schedule 160 fittings have those factors, but such fittings are not suitable for welding to



3 CHART FOR VALUES of C in Formula $H^2 = C\triangle EDi/S$ shown above



4 THESE VALUES of f, appearing in Formula $K = fH^3$ are used to determine anchor reactions by Formula $F = \triangle EI/K$

Schedule 40 pipe. It is suggested that the outside diameter be increased from 8.625 in. to 9.8 in. and the inside diameter left at 7.981 in., suitable for welding and favorable flow. The tangent ends should be long enough to allow an external taper from 9.8 in. to 8.625 in. for welding to Schedule 40 pipe. The difference in outside diameter combined with an identification stamp would serve to show that special expansion loop ells had been used in the fabrication.

Again, it should be possible to make use of socket weld fittings that appear to have low stress factors. It will take some research and testing with the application of alternating bending to the point of destruction. Then, after the reinforced fittings have been proved and accepted in the Code, it may be possible to forget stress intensification if these special fittings are used. The Code, as it is now written, appears to allow such fittings if the proper calculation of stress intensification can be made as now outlined in the Code.

If the stress intensification factor had been unity instead of 2.42, in the case of the first example, the height of the loop would have been 16 ft, 6 in. instead of 25 ft, 8 in. The difference is 18 ft, 4 in. insulated pipe underground in conduit. The difference in cost is over $600.

The same applies to the second example, where i for 8 in. Schedule 80 ells is 1.72. If Schedule 160 could have been used with $i = 1.0$, H would have been 254 in. = 21 ft, 2 in., a saving of 13 ft. In this case, however, the added cost of the special fittings would overbalance the saving in pipe cost.

There are many examples of expansion loop designs in which "reasonable doubt exists as to the adequate flexibility of a system." For example, an 8 in. pipeline 200 ft long, intended for steam at 500 psia and 470 F, has an expansion loop in which H is 12 ft. $W = 2H = 24$ ft and $G = \frac{1}{2}W = 12$ ft. This is for an outdoor line where −20 F occurs frequently. The erection temperature may be 80 F at which time 3.5 in. of initial cold spring is specified in the design. The pipe material is lap welded A 53, which has an allowable stress value of 9000 psi.

The expansion from −20 to 470 F is 4.015 in. per 100 ft. For the 200 ft line the change in length is 8.03 in.

From 80 to 470 F the line expands 6.58 in. so that from −20 to 80 F there is a difference of 1.45 in.

The contraction of the pipeline of 1.45 in. in cooling from 80 to −20 F, plus the initial cold spring of 3.5 in. produces a total cold spring of 4.95 in. The hot expansion is 8.03 − 4.95 = 3.08 in.

The longitudinal stress due to pressure is:

$$500 \times (50/8.4) = 2980 \text{ psi.}$$

Subtracting this from 9000 leaves 6020 psi for the allowable bending stress in pipe lengths G and W, which are made of A 53.

Welding ells, on the other hand, are generally forged from A 106 Grade B in which the allowable maximum stress is 15,000 psi. In this case, this allows a bending stress of 12,020 psi. Stress intensification factor i is 2.42. H^2 in inches is $144^2 = 20{,}736$. $D = 8625$ in., $E = 28$ million at 470 F, and, at −20 F, $E = 29$ million psi. The value of C for this loop is 0.214.

The maximum bending stress at 470 F is:

$$S = (0.214 \times 3.08 \times 28 \text{ million} \times 8625 \times 2.42)/20{,}736 = 18{,}600 \text{ psi}$$

The bending stress along section G and W in which stress intensification does not occur is 7690 psi.

Maximum bending stress when shut down at −20 F is:

S = (0.214 × 4.95 × 29 million × 8625 × 2.42)/20,736 = 31,000 psi

Even with welding ells designed for a stress intensification value of 1.0, the stress at −20 F would be 12,800 psi. This also is too high for A 53. These excessive stresses require that a change shall be made in the design.

Five Ways to Reduce Stress

There are several ways of reducing the stress:

1) Let W equal 4 H with G = 0.5 W and with C = 0.1154.

2) Use Schedule 80 pipe which will reduce the pressure stress and allow more for bending. At the same time, the factor i is reduced from 2.42 down to 1.72.

3) Use Schedule 40 seamless A 106 grade B.

4) Proportion the cold spring for equal stress at both the highest lowest temperatures.

5) Try using (1) and (4) of the above, but retain material A 53 for the reason that the maximum stress occurs in the ells and not in the pipe sections G or W.

Using formulas 8 and 9, —

[8] is N = $(E_h \times S_c)/(E_c \times S_h)$ = (28 × 15)/(29 × 12) = 1.207

[9] is Δ_e = $N/(1 + N)$ = 1.207/(1 + 1.207) × 8.03 = 0.547 × 8.03 = 4.38 in.

Δ_c = 8.03 − 4.38 = 3.65 in.

The initial cold spring should be 4.38 − 1.45 = 2.93 in. Then:

H^2 = (0.1154 × 4.38 × 29 million × 8625 × 2.42)/12,000 = 25,496; and H = 159.67 = 13 ft, 3¾ in.

W = 53 ft, 2½ in.

G = 26 ft, 7¼ in.

From this it appears that the increase in the length of G and W is the main factor in reducing the stress. With these dimensions, the stress at −20 F in the A 53 sections G and W is:

S = (0.1154 × 4.38 × 29 million × 8625 × 1)/25,496 = 5000 psi.

The anchor reaction is:

F = $(\Delta E I)/K$ and K = 2.17 H^2

F = (4.38 × 29 million × 32.5)/(2.17 × 159.67²) = 468 lb ⧺

Outdoor Thermostats To Control 1710 Air Conditioning Units

THE 1710 HIGH VELOCITY, below the window heating-cooling units in the new 24 story Prudential Tower, now under construction in Newark, N. J., will all be controlled automatically by eight outdoor thermostats, according to Vermilya-Brown Co., Inc., heating, piping, and air conditioning contractor for the project. Two outdoor thermostats will be on the north, east, south, and west faces of the building. Indoor thermostats will control a low pressure, recirculated closed circuit heating-cooling system, using ceiling ducts, which will serve the central area of each floor.

The refrigerating equipment required to provide the chilled water for the cooling cycle for the 24 floors consists of three 800 ton and two 310 ton refrigerating compressors, with provision for a future 800 ton compressor; four chilled water pumps with a total capacity of 8600 gpm and three condenser water pumps with a total capacity of 9600 gpm, and one standby pump with a capacity of 3200 gpm; a four-cell cooling tower unit with a total capacity of 11,500 gpm, and with a temperature range from 95 to 85 F.

Eight pumps with a total capacity of 1900 gpm, and two standby pumps with a total capacity of 745 gpm circulate the chilled water and hot water to the air conditioning units below the windows.

Nine air conditioning fan units with a total capacity of 364,000 cfm will deliver tempered air to the window units and ceiling outlets. Seven other fans, with a total capacity of 246,800 cfm, will return air from these spaces. This air will be recirculated or exhausted as temperature conditions require. Eight supply fans with a total capacity of 181,800 cfm, with heating coils, and 15 exhaust fans having a total capacity of 236,200 cfm will provide ventilation for spaces not air conditioned.

Voorhees Walker Smith Smith & Haines, architects and engineers for the Prudential Tower, designed the heating-cooling system. ⧺

Conference Session Planned for ARI Exposition, November 2-5

A "CONFERENCE TYPE" SESSION, with outstanding speakers on refrigeration and air conditioning, to be held in conjunction with the 11th Exposition of the Air Conditioning and Refrigeration Industry, at Atlantic City in November, has been planned by the Exposition Committee.

Arrangements are being made for speakers and subjects which will be of interest to architects, consulting engineers, and others. The conference session will be held at 10 a.m., either Tuesday, November 3, or Wednesday, November 4.

Sponsored by the Air-Conditioning and Refrigeration Institute, the exposition will run from November 2 through 5. ⧺

INDUSTRIAL VENTILATION:

How to Design Hot Water Heating To Protect Against Freeze-ups

• A small amount of hot water, passed through a well designed and properly controlled piping system, affords a good way to minimize freeze damage to industrial ventilation systems handling freezing outdoor air. Here, the author tells briefly how to design such a system.

Mr. Rottmayer was awarded his BS in mechanical engineering from the University of Illinois in 1926. He is a partner in the consulting engineering firm of Samuel R. Lewis and Associates, and has had extensive experience in the design of heating and air conditioning systems.

BY S. I. ROTTMAYER
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THE INTRODUCTION of outdoor ventilation air into an industrial plant usually is accompanied by hazards which can cause physical damage to ventilating equipment. This is especially true if the outdoor air temperature is near or below freezing. The use of hot water in well-designed piping, with the proper controls, can minimize freeze-ups.

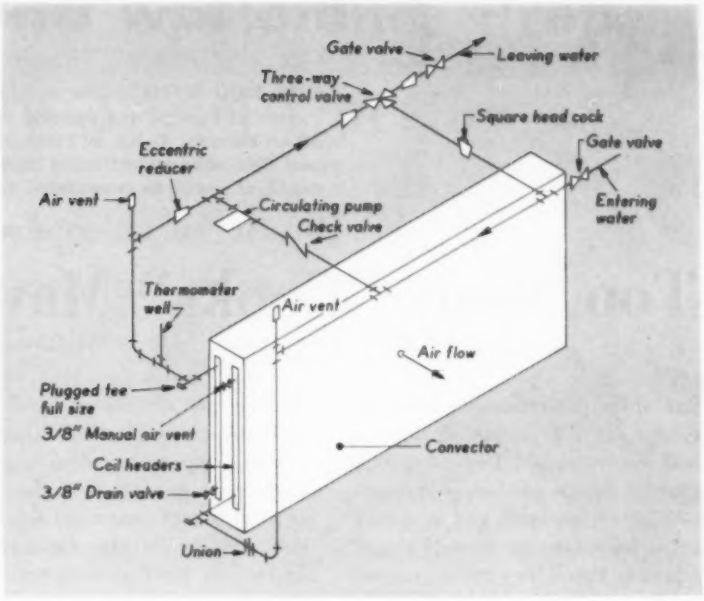
Modern heat transfer equipment for warming air consists of extended surface convectors over which the air to be warmed is passed and through which the heating medium is circulated. Such equipment can be utilized successfully and efficiently when there is uniform distribution of both the air and the heating medium with respect to the transfer surface.

The popular shop assembly of these convectors — with an air supply fan, air filters, and a "mixing box" — is a compact arrangement. In larger sizes it comprises multiple double-inlet centrifugal fans having a common shaft set closely against horizontal tubular convectors which may be as long as 10 ft.

The air filters are next upstream from the convectors, with the "mixing box" in front of the filters. For ventilating service the "mixing box" contains adjustable dampers in its openings for outside and recirculated air. For makeup air service it would have only the dampered opening for outside air.

With such assemblies, air distribution over the heat transfer surface tends to be less than uniform, both as to velocity and to temperature. This is especially true if steam is used as the heat transfer medium. Difficulties with freezing are not uncommon when steam is used in long tubular convectors.

The use of hot water for heat transfer in such assemblies can help eliminate many of the difficulties encountered with freezing. Water normally will not freeze if kept



1 BASED ON CONCEPT that water normally will not freeze if kept moving, piping and controls for freeze protection of industrial ventilation systems can be designed at convectors as shown here. Three-way valve responds to temperature to admit just enough hot water to satisfy thermostat; circulating pump keeps it moving

moving within the convector. Its temperature can be varied easily and stably over a wide range to suit load conditions. Temperature stratification of air, due to nonuniform distribution of the heating medium within the convector, is eliminated with pumped water in the tubes.

Base Design on Water Movement Concept

Based on these concepts, piping and controls can be designed at water convectors, as illustrated in Fig. 1. The three-way valve responds to the temperature of the air in the space or in the duct leaving the fan to admit only as much hot water from the central plant as is called for by the thermostat. The pipeline circulator is installed on the coil side of the valve and keeps the water moving within the convector at all times.

To conserve electricity, the pump motor circuit is opened whenever the three-way valve is in full bypass position or the supply fan is not running.

The temperature of the hot water from the central plant is of no major importance with this control arrangement, so long as it is high enough to warm the air to design conditions. It is always advisable to vary the water temperature from the central plant inversely with the outdoor temperature. In this way radiation losses are conserved and control equipment is exercised.

It is also advisable, as a safeguard against mechanical failure of the pump or any of the control components, to provide an additional freezestat in the air downstream of the convector, arranged to shut down the fan at a preselected temperature.

The recirculating pump selection should be based on moving the design water quantity required to supply the heating load of the convector at 20 or 30 F temperature drop, at the resistance of the piping circuit in which it operates. The three-way valve is designed for a pressure drop equal to 10 percent of the piping system total resistance.

If the temperature of air entering the convector is never less than freezing, the pipeline recirculating pump and bypass check valve can be eliminated.

Another control method for hot water convectors is the use of face and bypass dampers. Because of the inherent air leakage of dampers, the water temperature must be varied inversely with the outdoor temperature to prevent overheating at light loads. This method is particularly adaptable to systems using the same convector for cooling.

Don't Use Throttling Valves for This Service

The use of throttling valves for control of water convectors is not recommended for the following reasons:

1) For coils handling outdoor air, they afford no protection against freezing.

2) The quantity of water circulated through the system is changed by action of throttling valves, with resulting complications to pressures in the system; i.e., "churning" of the pumps (necessitating some device for bypass relief to avoid damaging the pumps) and possible reduction of water flow through the boiler (if a water boiler is employed).

3) To be reasonably effective in controlling over the full range of the convector output, throttling valves must be high quality, characterized port type, selected with meticulous care for the pressure and flow conditions encountered. Also, they must be operated by thermostats that are capable of utilizing the valves' characteristics. It is questionable that the results justify the costs, when there still exist the inherent deficiencies enumerated above. ∓

the law and your profits

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background. This series present actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Too Many "Cooks" May Botch the Job

THE MORE contractors on a job the greater the risk of having their efforts uncoordinated. Lack of unity is almost certain to produce poor results, both in workmanship and in money, as the following case shows.

Kumfit Hotels, Inc. began remodeling its hostelry during March a few years ago. Included in its plans was the air conditioning of lobby and basement floors. Moar Kumfit, president, consulted Tempen & Son, air conditioning contractor. Tempen, with C. Howe Guhd, representative of Floe-Ayr, sold Kumfit a 50 ton package air conditioning unit of Floe-Ayr's manufacture.

It was intended that Tempen should install the unit. However, general contractor Bilthaus Construction Co. had subcontracted with Doowell for installation of the air conditioning ductwork. Under his contract, Doowell insisted on installing the unit, also. As a matter of fact this subcontractor had a sub-subcontractor, Duzzit Engineering Co., to handle the actual installation work.

The unit, as was delivered to the hotel, was too large to be taken from the lobby to the basement through the available openings, so Duzzit took out the refrigerant and cut the unit into four parts with a blow torch. These laid in dust and dirt until May, when the unit was reassembled.

After being put into operation and running two hours, the unit broke a seal and lost its refrigerant. The hotel's maintenance man got another seal through Floe-Ayr's representative (Guhd), added new refrigerant, and restarted the unit. Two days later the compressor broke down.

Manifestly, too many cooks were spoiling the anti-caloric broth. And still more complications were to follow. Tempen was called in and he made arrangements with the manufacturer of the compressor for a new one. Adding to the confusion, I. Ficks, the hotel maintenance man, thought this had been done through Guhd. This came out before the trial court in the course of much conflicting testimony when Kumfit sued Tempen and Floe-Ayr on their warranty.

It appeared in the testimony that six weeks later the second compressor had also broken down and had to be replaced by a third.

In September, Floe-Ayr sent the Kumfit Hotel "a new blower and blower housing." During that month, the hotel's attorney wrote a letter to Tempen claiming total failure of consideration and demanding refund of the purchase price plus damages. The lawyer stated that suit would be filed within one week if his client were not compensated.

A meeting was held at which Tempen, Guhd, Ficks, Kumfit and his attorney, and representatives of Bilthaus and Doowell were present. Tempen said that if he were given "full control of taking care of the machine, he would see that it worked efficiently." Kumfit agreed to Tempen's proposal and forbade anyone else to touch the unit from then on.

Floe-Ayr had an investigation made by its engineer, thus bringing an additional person into the already crowded array. His findings, submitted in a letter to Kumfit, called for inspection of all inoperable parts.

After receiving this letter, Kumfit nevertheless authorized Tempen "to check, inspect, and advise as to apparent repairs." That firm worked on the unit during the spring and summer, for which it counterclaimed $2222 compensation against Kumfit.

The ensuing three years witnessed a complex of reports, claims, and counterclaims (accompanied by ceaseless and cross-purpose tinkerings by the various parties). A partial summary is afforded by the answer set up to Kumfit's suit against Tempen for refund and damages:

Abrasive and foreign material and mixture, said the defendants, got into the unit when it was cut up and left in the basement disassembled. Tempen also offered evidence that the unit was improperly operated by Ficks, who did not give it proper care and attention. Furthermore, according to defense evidence, the unit could have been disassembled by unbolting, thereby making it unnecessary to cut it with a torch.

The trial court found *for* plaintiff Kumfit against both Tempen and Floe-Ayr for $12,480, but found *against* Kumfit and for both defendants on "failure" of consideration. The jury found *for* Tempen against Kumfit for his $2222 counterclaim. All parties appealed.

In a long and involved opinion, the state supreme court affirmed the counterclaim of Tempen against Kumfit; judgment for Kumfit against Tempen for damages was reversed; judgment for Kumfit against Floe-Ayr for damages was reversed and the case remanded for trial on the issue between Kumfit and Floe-Ayr.

In short, all parties, particularly Tempen and Floe-Ayr, are heavily out of pocket as the result of protracted, expensive litigation. ∓

Fuel Combustion Conference Probes For Answers to Three Questions:

- ***where do we stand?***
- ***where are we going?***
- ***how are we going to get there?***

RESEARCH in the field of combustion for heating must be stepped up if we are to keep pace with future needs, stated L. N. Hunter, vice president of engineering, National-U. S. Radiator Corp., in his summary address to the combustion conference sponsored recently by the American Society of Heating Refrigerating and Air-Conditioning Engineers in Cleveland. The conference, held at the society's research laboratory, was attended by 75 engineers closely concerned with combustion of fuels.

Mr. Hunter cited the extensive research that has been conducted, but pointed out that present-day combustion is still a relatively crude process and much exploration still needs to be done to find new and more economical methods.

Opening the meeting, conference chairman M. W. McRae, directing engineer, Crane Co., indicated that we should scrutinize the research that has already been conducted in order to find out just where we stand. Then, he said, we should decide what our needs are and plot a course for future research to meet them.

These prime objectives of the conference were met through comprehensive discussions on burner performance and fuel oil properties, atomization of liquid fuels, mixing of fuels with air, and tomorrow's combustion methods.

Better No. 2 Fuel Oil Specs

Performance of oil burners could be greatly improved if the specifications for No. 2 fuel oil were improved, reported John G. Partch, Standard Oil Co. of Ohio. He said that the minimum gravity specification is most important, and a definite minimum and maximum range should be adopted.

Viscosity of fuel oil should also have definite limits for good combustion, as should distillation characteristics. Actually, viscosity requirements vary widely in different sections of the country, he said. Standardization of these specifications will undoubtedly improve burner performance, concluded Mr. Partch.

Speaking on another phase of fuel combustion, R. P. Gilmartin, Gulf Research and Development Co., stated that the storage stability of distillate fuel oil is a most important characteristic. He also suggested that oil burner research be continued:

1) To improve oil burners.

2) To give further critical study to oil burner accessories.

R. C. Wright, vice president of Iron Fireman Mfg. Co., listed the following characteristics for the various grades of fuel oil as being applicable to heating:

1) No. 6 fuel oil has the smallest practical burning rate: 25 gph. Viscosity variation from 750 to 8000 SSU at 100 F presents the main obstacle in its use. Preheating is generally required.

2) No. 5 fuel oil is characteristically unstable in storage, being subject to gravity separation. Its viscosity varies from 250 to 2000 SSU at 70 F. Specifications for No. 5 fuel oil should call for a range from 200 to 400 SSU for uniformity. Preheating is generally required, except for a few borderline cases.

3) Use of No. 4 fuel oil is limited, he said, and was not discussed.

4) Uniformity of both viscosity and specific gravity are important to No. 2 fuel oil, as mentioned earlier. In storage, No. 2 fuel oil has a tendency to develop chemical changes that result in formation of objectionable gums, according to Mr. Wright.

What an Atomizer Should Do

Nozzle design with reference to atomization of liquid fuels was discussed by Eugene O. Olson, Delavan Mfg. Co. He pointed out that an atomizer should (1) break up the oil into small droplets, (2) meter fuel to the combustion chamber and (3) discharge it into the chamber in a pattern.

He went on to explain how the fuel leaves the orifice of a pressure atomizing nozzle in the form of a thin film of liquid. This film separates into ligaments which in turn are separated into droplets by surface tension and by the resistance of the ambient air. Droplet size varies with supply pressure, flow rate, spray angle, viscosity, and surface tension.

In present day burners, the spray pattern is very important. High viscosity fuels in small nozzles cause deterioration of the spray pattern, resulting in smoky and noisy operation. This is an important consideration because of the trend to lower firing rates.

Mr. Olson recommended:

1) Specifications for domestic burner fuel should be changed and enforced to meet the needs of modern small burners.

2) Burners could possibly be redesigned to operate at lower atomizing pressures.

3) New means of atomizing fuel should be investigated.

Contaminants in fuel oil are of two general types, according to John A. Bolt, Standard Oil Co. of Indiana. These are (1) external, such as dirt, rust, water, and other residues; and (2) fuel generated sediment, such as gum. He said the external contaminants can be eliminated by care in handling and the use of anti-rust additives, filters, and screens. Fuel generated contaminants can be eliminated by using a stable fuel oil.

Storage qualities are improved by having stable stocks, proper treating, and using the right kind of additives. Thermal stability is important for its effect on atomization as it affects the coking of nozzles. He pointed out that whatever improves storage stability also generally improves thermal stability.

Mr. Bolt recommended that oil burner filters be standardized and that standard test procedures for them be adopted. He also suggested that the types of traps and dirt and water separators that are required be determined carefully to insure effective removal of contaminants.

Another suggestion by Mr. Bolt was that uniform test procedures for heating fuels be developed so that minimum stability requirements can be set and followed.

Study Mixing Fuels with Air

The mixing of fuels with air for combustion was discussed by A. A. Putnam of Battelle Memorial Institute, Walter B. Kirk of the American Gas Association testing laboratories, and Richard G. McCafferty of the National Aeronautics and Space Administration.

Mr. Putnam pointed out that heat release rates of fuel oils are affected by (1) momentum of fuel and air spray and (2) the atomization pressure to break up the fuel and get it where it will burn most effectively. He went on to say that, based upon recent data, there is a relatively large amount of fuel and a small amount of air at the apex of the spray cone, and suggested that this relationship needs further study.

Mr. Putnam summarized his remarks by stating that the amount of heat produced in the combustion chamber depends on the chemistry of the fuel, the turbulence of distribution in the combustion chamber, and the products of combustion.

Mr. Kirk presented information on gaseous fuels, pointing out that the mixing of these fuels with air is accomplished in two stages: primary and secondary aeration. He urged that more research be conducted on both stages. He also recommended that a study of preburner mixing be made, and stressed the importance of setting the correct proportion of air and fuel to obtain proper combustion. There should be enough primary air to eliminate the yellow tip of the flame, he said.

Mr. McCafferty spoke on high speed combustion systems in turbojet and ram-jet engines and told how a 2000 volt electrical field surrounding a flame can improve flame stability. He explained how this control is achieved through electrons given off.

The relationship of combustion to air pollution was discussed by Wesley C. L. Hemeon of Hemeon Associates. He noted the increasing importance of air pollution control, at the same time citing the confusion that exists regarding it. Air pollution is really not complicated, he said, because it is either a health hazard or a nuisance.

Seven sources of air pollution, in the order in which they most commonly occur, were listed by Mr. Hemeon: (1) dust fall, (2) fine particles, (3) odors, (4) sulfur dioxide, (5) fluorides, (6) smog, and (7) all others. Types 4, 5, and 6 affect vegetation and are corrosive.

In conclusion, Mr. Hemeon stressed the need for complete combustion of all fuels as one means to control air pollution.

A Look to the Future

Catalytic combustion as a future extensively used combustion technique was discussed by Walter Ross, National-U. S. Radiator Corp. He explained how this principle is being used with almost flameless infra-red space heaters. In the presence of a catalyst, the speed of the chemical reaction is increased, but the catalyst remains unaffected. He suggested that a proposed combustion system include air and fuel intakes, pump, mixer, burner element, and required heat transfer surface.

In listing its advantages, Mr. Ross said that catalytic combustion is stable, is flameless, affords high heat flux, has no flashback, resists thermal shock, is safe, is easy to control, is adaptable to several fuels, has long life, and has a wide range of fuel to air ratios. Among the variables to be studied are consistency of material, size, free area, diameter of burner, flow rate, thermal conductivity, permeability, and density of material. The unit would be built around refractory or ceramic material. Gaseous fuels present fewer problems than oil fuels, Mr. Ross concluded.

Everett Gorin, Consolidated Coal Co., described the fuel cell as one new method for converting fuel directly to electricity without going through the conventional thermal cycle. He explained that the cell is an electrochemical device and operates on a continuous basis.

These cells have been found to operate most successfully with gaseous fuels, the most generally used being hydrogen. The high cost of hydrogen limits its use, he said.

A high temperature cell is equipped with two electrodes, one in the fuel gas chamber and the other in the air chamber. An electrochemical reaction takes place in an oxide plate electrolyte separating the electrodes. A low temperature cell performs better with hydrogen than with carbon monoxide. The CO cell operates best with low voltages — about 1 volt per cell.

Mr. Gorin, pointing up the need for further study in this area, stated that more efficient and more fully developed fuel cells should be designed that would have long service life, relatively low first cost, high unit output, and relatively low fuel cost for operation. ≠

Steam Pipe Sizing Data

THIS STEAM pipe sizing data, just recently made available for publication, is appearing in HPAC Data Sheets in four parts, concluding in the September issue. The first part was published in June.

All tables are based on dry steam flowing through Schedule 40 steel pipe. The Moody Friction Factor has been used in computing pipe capacities and friction losses.

Table 1 (June) lists steam main capacities for low pressure vacuum systems. Table 2 (below) presents capacity data for the piping *between* the supply mains and the heating surfaces themselves. This information is based on a maximum pressure drop of 1 psig, or 16 oz.

For a given system, the sizing of the steam supply piping requires the use of *both* Tables 1 and 2. Therefore it should be noted that the 16 oz pressure drop for branch piping, risers, and runouts is *in addition* to the 40 oz drop specified in Table 1 for the supply mains.

This data is being published through the courtesy of the Nash Engineering Co.

TABLE 2—CAPACITIES OF STEAM SUPPLY PIPING from mains to heating surfaces are listed below. Data is based on steam at 2 psig initial pressure. Total friction loss is 1 psi (16 oz). Capacities are given in square feet of equivalent direct radiation (To convert to pounds per hour, divide by 4). Velocities are in feet per minute

TOTAL DEVELOPED LENGTH FEET	PIPE DIAMETER - INCHES					
	1"		1-1/4"		1-1/2"	
	LOAD SQ.FT.	VELOCITY F.P.M.	LOAD SQ.FT.	VELOCITY F.P.M.	LOAD SQ.FT.	VELOCITY F.P.M.
40	500	8300	1050	10000	1580	11100
50	440	7300	930	8800	1400	9800
60	400	6600	840	8000	1260	8900
70	370	6100	780	7400	1160	8100
80	340	5600	720	6800	1080	7600
90	320	5300	675	6400	1020	7200
100	300	4900	640	6100	960	6700
120	275	4500	580	5500	870	6100
140	255	4200	535	5100	800	5600
160	235	3900	500	4800	740	5200
180	220	3600	465	4400	700	4900
200	210	3500	440	4200	660	4600
220	200	3300	420	4000	630	4400
240	190	3150	400	3800	600	4200
260	180	2950	380	3600	570	4000

TOTAL DEVELOPED LENGTH FEET	PIPE DIAMETER - INCHES					
	2"		2-1/2"		3"	
	LOAD SQ.FT.	VELOCITY F.P.M.	LOAD SQ.FT.	VELOCITY F.P.M.	LOAD SQ.FT.	VELOCITY F.P.M.
40	3050	13000	4900	14600	8700	16800
50	2730	11600	4350	13000	7700	14900
60	2450	10400	3950	11800	7000	13500
70	2290	9700	3650	10900	6500	12500
80	2100	8900	3400	10100	6000	11600
90	1980	8400	3200	9500	5700	11000
100	1900	8100	3000	8900	5400	10400
120	1720	7300	2750	8200	4900	9500
140	1570	6700	2500	7500	4500	8700
160	1480	6300	2350	7000	4200	8100
180	1380	5900	2200	6600	3900	7500
200	1300	5500	2080	6200	3700	7100
220	1240	5300	1980	5900	3550	6900
240	1160	5000	1890	5600	3350	6500
260	1130	4800	1810	5400	3200	6200

(Continued on next page)

Table 3 is a tabulation of friction losses per 100 linear ft of pipe, or the equivalent. It is based on an initial pressure of 5 psig and may be used for steam main calculations in preference to Table 1. With Table 3, pressure losses can be determined more accurately than is possible with Table 1, or pressure losses may be calculated for different conditions.

Due to space limitations, only pipe sizes ranging from 1 in. to 2½ in. are given here. Data for sizes from 3 in. to 16 in. will be published in the August Data Sheet.

TABLE 3—FRICTION LOSSES per 100 linear ft of pipe in sizes 1 in. to 2½ in. are tabulated below. Data is based on steam at 5 psig initial pressure. Pipe is Schedule 40 steel. Loads are in square feet of equivalent direct radiation and in pounds per hour. Velocities may be calculated as shown at bottom of page

PRESSURE LOSS OUNCES - PER 100 FEET OF STEEL PIPE						
LOAD	PIPE SIZE - INCHES					LOAD
SQ.FT.EDR	1"	1-1/4"	1-1/2"	2"	2-1/2"	LBS.PER HOUR
50	.51					13
75	1.05					19
100	1.75					25
125	2.62	.63				31
150	3.65	.96				38
175	4.80	1.26				44
200	6.2	1.60	.76			50
225	7.7	1.98	.93			56
250	9.3	2.39	1.13			63
275	11.1	2.84	1.34			69
300	13.1	3.33	1.59			75
350	17.5	4.43	2.09			88
400	22.5	5.7	2.67	.79		100
450	28.1	7.1	3.29	.98		113
500		8.6	4.03	1.18		125
550		10.3	4.80	1.41		138
600		12.1	5.7	1.64		150
650		14.1	6.5	1.91		163
700		16.1	7.5	2.19	.91	175
800		20.9	9.7	2.79	1.16	200
900			12.0	3.46	1.44	225
1000			14.7	4.23	1.74	250
1100			17.7	5.1	2.08	275
1200			20.7	5.9	2.43	300
1300				6.9	2.83	325
1400				7.9	3.24	350
1500				9.0	3.68	375
1600				10.2	4.14	400
1700				11.5	4.66	425
1800				12.8	5.2	450
1900				14.1	5.7	475
2000				15.6	6.3	500
2200				18.6	7.5	550
2400				22.1	8.9	600
2600					10.4	650
2800					11.9	700
3000					13.6	750
3200					15.4	800
3500					18.3	875
4000					23.8	1000

VELOCITIES

TO OBTAIN VELOCITY IN FEET PER MINUTE, MULTIPLY LOAD IN SQ. FT. EDR BY PROPER FACTOR SHOWN BELOW:

	PIPE SIZE - INCHES				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
FACTOR	14.15	8.16	6.00	3.64	2.55

Winning the Air Conditioning Odor Fight

Round 7:

The Knockout Blow

• In this series of articles, appearing in the January through June issues, Mr. Hubbard has discussed the ability of the nose to detect and evaluate odors, the physical properties of odors themselves, the effects that temperature and humidity have on them, and some of the cures for specific odor problems. In this the final round he turns to another common air conditioning odor source—the cooling coil—and tells what to do about it.

The author, a long time member of the ASHAE Technical Advisory Committee on Odors and its chairman during 1956-57, was with General Electric Co.'s air conditioning department for many years and has had much experience in the design of air conditioning systems.

BY ALBERT B. HUBBARD

TO PARAPHRASE a familiar saying, "All cooling and no off-cycle operation makes Jack, the cooling coil, a foul boy."

Although I jest about coil odor, it is not taken lightly by an air conditioning unit's owner. Coil surfaces can adsorb odors whenever the conditioner's intake includes odorous vapors, even if these are below threshold concentration. If the odors are desorbed regularly, no harm is done; but if the unit is used so continuously that the odors cannot desorb, the stench can become unbelievable.

Ventilation, eliminating cabinet leakage air, and taking in sufficient outdoor air—odor cures discussed in my last two articles—will not help in this problem.

But before launching into solutions, let me describe the perfect example of coil odor. I will never forget it. A large annex of a bar and grill was used exclusively for parties. These usually were wedding receptions, in a neighborhood where marriages were celebrated in the presence of numerous guests with exotic and plentiful food, drink, and good cigars. The space was crowded to the point where cooling was needed regardless of weather. After each party, the air conditioning units were turned off to stew in their odor accumulations until the next celebration. The stench was horrible and soon built up to the point that it prevailed over the fresh aromas of a party.

This sort of situation can happen anywhere and is predictable. Corrective provisions, based on encouraging

12 steps to good air

1) Make an odor survey before the air conditioning is installed. The after-air conditioning odor level will lie between morning opening and daytime levels. The exact level will depend on your positive odor prevention measures.

2) Educate the owner on good housekeeping practices. They are even more important with air conditioning than without it.

3) Locate exhausts near odor sources.

4) Ventilate in direct proportion to odor sources. If sources cannot be reduced, step up ventilation three times for perceptible improvement and 10 times for significant improvement.

5) Up average ventilation with 10 to 20 changes per hr of nighttime air.

6) Add more ventilation by running an exhaust fan, at five to 10 air changes per hr, during compressor off-periods.

7) Purge cooling coil odor accumulations, where the unit continuously cools without substantial off-cycle fan operation, using heat to speed it up.

8) Recognize olfactory habituation when surveying existing jobs. Separate unexpected odors from expected background.

9) Hunt for secondary, stale odors. Breathe on surfaces and sniff for odors desorbed by the moisture. If this test is positive, change the surface or step up housekeeping. Watch for or ask about rainy day odors.

10) Ventilate, isolate with plywood, or tape up the store cooler exiled to a smelly out-of-space spot. This ambient air is included in the air conditioning circuit.

11) Test outdoor air flow in the conditioner. Be prepared for less outdoor air than design calls for.

12) Above all, go to the scene for your facts. Swivel chair investigators are even less effective than doctors who diagnose by telephone. Develop alertness to odor results in air conditioned premises. When not good, try again.

desorption, ought to be included in the original layout. Merely running the fan will eventually clear a coil's odor load. This is a slow process and may foul the room unless adequate ventilation is simultaneously provided. To speed up desorption, heat the coil. With the coil surface at 100 to 120 F, the job will take perhaps 30 min, compared to about a week at room temperature. An ideal accessory is a duct to blow the foul air outside during the unloading period.

Coil odor can happen wherever the air conditioning unit is in effect controlled by a switch rather than a thermostat. Conference rooms and night clubs, while contrasting examples, share the common possibility of no time to unload coil odors. ≠

Air Conditioning Seen as Essential to Printing Industry

Eliminates delays caused by year 'round changes in temperature, humidity

AIR CONDITIONING is essential to proper printing, according to Herbert E. Phillips, supervisor of the applied research section of Rochester Institute of Technology and in charge of the department's printing laboratory.

The printing laboratory is used as a training facility and a test plant for printing equipment, ink, and graphic arts processes.

"Operating this plant without air conditioning would be extremely difficult," said Mr. Phillips. Accurate registration in color printing, efficient feeding of paper through the presses and elimination of delays due to year 'round changes in temperature and humidity are assured through the use of air conditioning.

Air in the printing laboratory is kept at 70 F and 45 percent RH. A reciprocating refrigeration compressor with 40 tons' capacity supplies chilled water to two fan-coil type air conditioning units. Air is distributed through overhead ductwork to ceiling diffusers, according to Carrier Corp.

Such features as air conditioning for temperature control, soundproofing for acoustical control, and insulation all increase the efficiency of today's factory. ≠

Submarine studies indicate . . .

Airborne Condensation Droplets, Ions May Be Major Health Factors

. . . in habitability of closed spaces

Studies of the submarine atmosphere, conducted aboard German U-boats during World War II, have established that airborne condensation droplets and ions increase with prolonged submergence. In this third and concluding article (see May, pp. 101-105, and June, pp. 123-125), Dr. Schaefer goes into the biological significance of these conditions on humans.

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SMALL IONS and ions of an intermediate size and velocity such as those found on submarines in these investigations have biological effects[1,2,3,4]. Symptoms of "hay fever" have been produced in patients with no allergy symptoms when they were subjected to positive ionization for periods of 15 to 30 min[5].

In these experiments, the air contained 6500 positive ions and 140 negative ions per ml, (small to medium size). The number of positive ions used in the treatment corresponds with the range of values found in submarines, although the simultaneously present number of negative ions was higher in the latter. Assuming these effects of short exposure to ionized air can be verified, then the chronic exposure to ionization would most certainly present a real problem.

The biological significance of the large ions is less clearly established. With speeds up to 0.0075 cm per sec/volts per cm, they are considered moderate sized ions by some investigators. About 20 to 40 percent of these ions remain in the lungs, whereas the major part of the small ions is absorbed in the respiratory tract and the majority of the ultra large ions is exhaled again[6].

It has been claimed that the stuffy feeling of overcrowded, overheated rooms is caused by an excess of positive ions or a deficiency of negative ones. An improvement of the physical conditions and subjective feeling can be achieved by supplying the compartment with negative ions[3,7].

There are some indications, that the gas exchange may be affected through air ionization. If CO_2 is added to negatively ionized air, the number of negative ions is rapidly diminished, while positive ions appear to be not affected. Negatively or positively charged air changes the CO_2 exchange in the organism and indirectly the utilization of oxygen. A slight increase in oxygen absorption and decrease in carbon dioxide excretion after inhalation of negatively charged air has been reported[8].

Although both of these studies were carried out under experimental conditions, which allowed no definite clarification of the problem involved, recent findings showing an increased CO_2 capacity of the blood of hamsters after exposure to negatively ionized air seem to suggest that the CO_2 exchange might be affected by air ionization[9]. This could be important in submarines, where the CO_2 content of the atmosphere will remain, for all practical purposes, somewhat elevated.

Not Enough Data on Chronic Ionization

Effects of chronic ionization have not been studied to an extent which would make the results applicable to conditions of prolonged exposure in submarines. It is necessary to establish time-concentration curves for this purpose. On nuclear powered submarines, radiation sources exist which could produce significant ionization of the submarine atmosphere. Besides gamma radiation, radon can produce ionization of the air.

The number of ions in the atmosphere of the submerged fleet type submarine has been shown to increase in a rather linear fashion and to decrease rapidly after surfacing. In the reported studies the submergence time was not long enough to reach an equilibrium. This might

take several days. In contrast, the aero-electrical processes of the natural atmosphere, like electrical field intensity and air conductivity, show a pronounced 24 hr cycle which corresponds with other processes of daily regularity[10,11,12].

This is an example showing how natural 24 hr environmental cycles, in the form of sine waves, are replaced on the conventional fleet type submarine by arhythmical processes lasting 12 to 18 hr, depending on the submerged time. If daily changes in ionization of the atmosphere should prove useful as an environmental time-giver in stimulating daily cycles of physiological functions, one might consider installation of ion precipitators and ion generators in confined spaces to control the ion content in the atmosphere and produce cyclic changes in ionization.

What Are Effects of Radiation Exposure?

For the discussion of the problem whether and to what extent the measured gamma irradiation exerts a physiological or a damaging effect, the values found must be compared with the doses of tolerance established for X and gamma rays. For human reproductive and other vital organs this amounts to 100 MREM per week[13].

For the conversion into *r*, the following ratio is valid: At a distance of 1 cm, 1 mg Ra produces 8.4*r* per hr. Hence, at a distance of 5 cm, 1 microgram produces 8.1×10^{-3} *r* (roentgens) per day.

The mean value of the figures determined at the points Nos. 6 and 7 (control room watch) in Table 1 in the second part of this article in the June issue averaged out at 57 impulses per min. This has a radium equivalent value of 2.04 micrograms. For this number of impulses, a radiation value per day of $8.1 \times 2.04 \times 10^{-3} = 0.164$ *r* per day was obtained, or 0.0546 *r* per day for an eight-hour watch. The radiation exposure of the personnel in the control room would amount to 38.5 milliroentgen per week. This is below the present weekly permissible exposure to total body penetrating radiation which is 100 milliroentgen equivalent. On the other hand, this exposure is much higher than exposure recorded aboard the USS Nautilus for the group of engineers, which amounted to 9 milliroentgen equivalents per week.

Studies reported here were, to our knowledge, the first investigations of condensation droplets, ionization, and gamma radiation carried out on a conventional submarine. On the basis of results obtained, attention was drawn to the problem of radioactivity caused by radium painted dials in submarines and to the existence of a second potential problem, namely, that of the effects of prolonged exposure to increased positive ionization[14].

In subsequent investigations, radioactivity measurements (Radon and its daughter products) were carried out in fleet type submarines containing radium painted dials under similar experimental conditions[15,16]. These have established the hazards of airborne radioactivity produced by luminescent radium painted dials.

Beta air activity on the Nautilus during submergence rose continuously for two to three days, at which time an equilibrium was approached[17]. Radon air concentration sometimes came pretty close to the permissible value. After removal of all radium painted dials and wristwatches from the ship, a significant reduction of beta air activity was observed. Curiously enough, the radiation effects of radium painted dials turned out to be problems of greater concern than the radiation effects from the reactors (which were practically eliminated due to excellent shielding).

Acknowledgements

These studies were made possible through the excellent cooperation of the late Professor E. Kuester, (former director of the department of bacteriology, University of Frankfurt,) and Professor B. Rajewsky director, Kaiser Wilhelm Institute of Biophysics, Frankfurt. The second series of studies was carried out jointly with Dr. Dreblow, also of the Kaiser Wilhelm Institute.

The author expresses his appreciation to Commanders R. L. Gade and J. H. Ebersole, USN, for their advice in the preparation of these articles.

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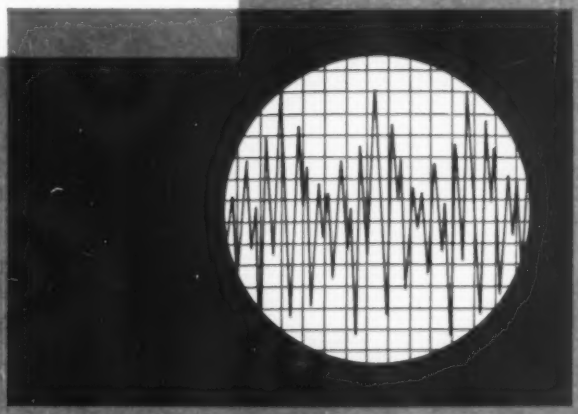
HPAC ENGINEERING DATA FILE

Some NOISE CONTROL Fundamentals

- What are sources of noise?
- How is noise transmitted?
- How much noise is generated in air distribution systems?
- How much attenuation in the system?
- How much noise is acceptable?
- How can system noise be reduced?



The sources of noise in air conditioning systems are numerous. Fans, compressors, and pumps by their nature must produce some noise. The flow of air in ducts and liquid in piping will generate noise when system components cause turbulence and eddies in the stream.

The noise generated at these various sources is transmitted to the listener by many paths. Some is transmitted through mechanical coupling, and some by airborne radiation. To limit the noise heard by the occupant, the path by which the unwanted sound is transmitted must be modified or the source must be quieted. The latter is largely the responsibility of the manufacturer but the designing engineer and the contractor must know the sources of equipment noise to be in a position to select quiet equipment. Modification of the paths by which noise is transmitted is the responsibility of the design engineer.

The noise generated and transmitted by an air distribution system may be one of principal acoustic problems in a building. This report considers the sources of noise in these systems and some of the factors to consider in design. An economical noise reduction design must consider many things. The sound generation and sound attenuation in the system and the attenuation due to sound absorption in the conditioned space are all important. The single number sound level, so long considered the standard for determining the acceptability of space noise levels, is not adequate for design. Designs must be based upon sound generation and attenuation in eight frequency ranges or octave bands. A procedure for doing this is given, recognizing that systematic investigations have not been made to evaluate the acoustic properties of many system components.

Some Fundamentals of NOISE CONTROL

although acoustic design data is limited, following the procedure outlined here can result in comfortably quiet systems

THE ACOUSTIC environment in which a person lives or works is important to his comfort and feeling of well being. Ambient sound levels may be simply annoying or they may, when of sufficient intensity, cause permanent hearing loss. The importance of controlling the latter, because of its affect on disability awards, labor relations, etc., is readily recognized. The effects of annoying sounds or noise are more subtle. Noise produced in air distribution systems are in this class. The noise emanating from a grille or diffuser may annoy some people and not others. To some people, the noise of an air system may indicate that the air conditioning is in operation. To others, it may be the steady sound needed to mask out undesirable ambient noises such as speech and intermittent use of light business machines. To the majority, however, excessive noise will be annoying. Such noise may lead to the rejection of an air conditioning system that is in all other respects well designed and that performs satisfactorily.

In the past several years much attention has been given to noise control in air conditioning systems. Methods of measurement and methods of predicting space noise levels have been developed. New criteria have been established for evaluating the degree of undesirability of noise. Part of this activity is the result of the development of the high velocity air distribution system with its greater fan horsepower, and because of higher air velocities, sources of noise generation within the duct system. A part of this activity is also a result of a change in what the user expects from an air

Some of the causes of noise in mechanical equipment are listed here. Knowledge of these will aid the designer in selecting quiet equipment. Periodic checks of some of these points will aid in maintaining quiet operation

- **Static and dynamic unbalance**
- **Improper application of bearings**
- **Poorly designed air cooling systems**
- **Poor alignment**
- **Loose parts**
- **Bent or bending shafts**
- **Loose fit of mechanical parts**
- **Improper assembly**
- **End play**
- **Hydrodynamic forces in cooling water or oil**
- **Rubbing and scraping of moving parts**
- **Alternating reaction of driven load**
- **Variations in magnetic forces**
- **Loose laminations in motors**

From "Noise of Mechanical Equipment" by R. J. Wells, Building Research Institute Conference on Noise Control in Buildings.

conditioning or heating system because of a change in living standards. Noise which has previously been accepted as an adjunct to thermal comfort is now most often considered undesirable.

While complete agreement as to approach has not been reached, much basic data is available with which to design a quiet system. A method of design is presented here in summary with other fundamental information needed to sound condition the air distribution systems of a structure.

What Are Sources of Noise?

One performance factor of mechanical equipment is the sound it generates and radiates to its environment. In heating, piping, and air conditioning systems the sources of sound are many and varied. Some which must be considered in acoustic design were listed[1] by C. J. Hemond, Jr. at the recent Building Research Institute Conference on Noise Control in Buildings as follows:

1) Fan motors
2) Fans

Definitions of Basic Acoustical

A number of terms have been defined which pertain to acoustics. Some of the terms commonly used in noise control literature are as follows:

Decibel — a dimensionless quantity expressing the ratio of two numbers on a logarithmic scale. By this means, the decibel range of 0 to 140 represents a range of sound pressure ratio of one to 10 million. When used in connection with the word "level" it always has an implied reference. In this report, decibels are further identified as dbe for sound power level, dbc for sound pressure level, dba, dbb and dbc for readings taken on the A, B, and C networks of the sound level meter, respectively, and as db where it applies to attenuation.

Sound level — the reading in decibels taken at a point in a sound field with a sound-level meter under conditions of the "American Standard Sound Level Meters for the Measurement of Noise and Other Sounds." The meter has three scales, A, B and C which correspond to the ear in loudness at designated levels when measuring pure tones (single frequency sounds). The A weighting network is used for sound pressures below 40 db (recorded as dba). It is insensitive to low frequencies. The B weighting network is used for levels between 40 and 70 db (dbb) and is more sensitive to low frequencies. The C network has no compensation so that all frequencies have equal treatment. This scale is used in conjunction with an octave band analyzer to obtain noise analyses for design purposes. Readings on the C network are recorded as dbc.

Octave band width — division of the range of noise frequency into bands such that the band width is one octave. The ratio of upper and lower frequencies of one octave is two to one. Common octave band frequency ranges are 37.5 to 75 cps, 75 to 150 cps, 150 to 300 cps, 300 to 600 cps, 600 to 1200 cps, 1200 to 2400 cps, 2400 to 4800 cps, and 4800 to 9600 cps. The upper and lower bands are sometimes extended to include 10,000 cps as the upper limit and 20 cps as the lower limit.

Frequency (f) — the rate at which sound pressure pulses occur at a point in a sound field. Frequency is given in cycles per second and may be calculated as the ratio of the speed of sound to the wave length of the tone.

Sound power (W) — the power in watts radiated from a sound source such as a fan or pump. This power is associated with the frequency of the sound and the range of frequency to which the power applies must be known.

Sound power level (PWL) — the ratio of measured sound power to a reference sound power expressed on a logarithmic scale and defined as follows:

$$PWL = 10 \log (W/W_r)$$

where:

W = measured sound power, watts
W_r = reference sound power which is usually 10^{-12} watts

The units of sound power level are decibels (dbe).

Sound intensity (I) — the average rate at

3) Compressors—both centrifugal and reciprocating
4) Water chillers
5) Pumps
6) Pressure reducing dampers
7) Branch duct take offs
8) Grilles, registers, and diffusers.

To this list other sources such as fan coil units and cooling towers might be added. These consist of combinations of some of the sources listed above and must be considered when designing the indoor acoustic environment. Noise may also be generated in piping systems and heat transfer units. When equipment radiates a part of its sound energy out of doors, consideration must also be given to the noise transmission to nearby structures.

The noise generated by mechanical equipment is caused by many things. Some of the principal[2] causes were listed earlier. Proper selection of components and the design of equipment to minimize the noise generated by these causes is the responsibility of the manufacturer. Awareness of them will aid the designing engineer and the contractor in selecting quiet equipment. The need for noise control will then be minimized. Periodic checking of these various points after the equipment is in operation will help to maintain quiet performance of a system.

[2]*Numerals refer to references listed on page 156.*

Terms Are Reviewed Here

which sound power is transmitted in a given direction through a unit area perpendicular to the direction. The units are watts per square meter (mks) or watts per square centimeter (cgs).

Sound intensity level (L_I) — ratio of two sound intensities expressed on logarithmic scale as follows:

$$L_I = 10 \log (I/I_r)$$

where:

I = intensity measured
I_r = reference intensity which is either 10^{-12} watts per sq m or 10^{-16} watts per sq cm

The units are decibels (dbi).

Sound pressure (p) — root mean square incremental pressure produced when a sound wave passes a point in an undisturbed medium. Sound pressure is measured in units of microbars (1 dyne per sq cm or 0.1 newton per sq m). One microbar is approximately one-millionth of a standard atmosphere. The ear can sense pressures in a range from maximum to minimum of ten million to one.

Sound pressure level (L_p) — ratio of measured sound pressure to reference pressure on logarithmic scale as follows:

$$L_p = 20 \log (p/p_r)$$

where:

p = measured sound pressure, microbars
p_r = reference sound pressure which is 0.0002 microbars

The units are decibels (dbc) indicating they are measured with the C or flat scale on a sound level meter.

Loudness (N) — The subjective attribute of a sound which people recognize. The units are *sones* and sounds are rated from soft to loud. The reference sound is a 1000 cps tone with a pressure level of 40 dbc and has a loudness of one sone. The loudness scale ranks sounds in a relative order. Thus, a noise with a loudness of two sones sounds twice as loud to the ear as a noise with a loudness of one sone.

Loudness level (L_N) — a measure of the relation between loudness and frequency for the average ear. Loudness level ranks sounds in order which are numerically equal to the sound pressure level of a simple tone of 1000 cps frequency judged by listeners to be equivalent in loudness. The units are phons.

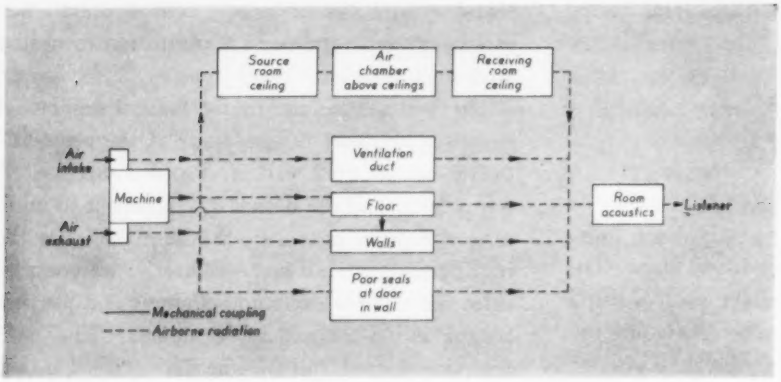
Attenuation (R) — the ratio of intensities of I_1 and I_2 along a sound transmission path expressed in decibels. Hence, the reduction in sound power due to the nature of the path of noise transmission. The units are decibels (db) and attenuation is calculated as:

$$R = 10 \log (I_1/I_2)$$

Transmission loss (TL) — Similar to attenuation but used to describe the energy loss when sound is transmitted through a barrier such as a wall. This loss is the ratio of the intensity of the wave incident on the exposed surface to that transmitted by the exposed surface. The units are decibels (db) and it is defined as:

$$TL = 10 \log (I_1/I_2)$$

Noise reduction (NR) — the difference in the sound pressure levels existing on the two ends of a sound attenuation device.



1 NOISE may travel from mechanical equipment to a listener by many paths, some of which are shown here

Paths of Noise Transmission

Noise that cannot be controlled at the source—some noise is inherent in the function of mechanical equipment—must be controlled by modifying the path along which the sound is transmitted. The paths of noise transmission as outlined by R. J. Wells in his paper[2] presented at the BRI conference are shown diagrammatically in Fig. 1. The solid lines indicate mechanical paths of transmission and the dashed lines indicate airborne sound.

Improper mounting of equipment will allow the vibrations of a machine to be transmitted to adjacent rooms through the mechanical coupling illustrated. The walls as well as the floor may vibrate and become radiators of sound. Locating major mechanical equipment remote from quiet spaces and the use of proper vibration mountings will minimize the noise transmitted in this way.

Airborne sound may be transmitted along a number of paths as shown. It may also be transmitted from the surfaces of ducts and other air distribution devices above false ceilings to the ceiling and then to the room. The latter is especially possible in high velocity air distribution systems due to sound radiation from ducts, mixing units and attenuators.

It will be noted that all of the transmission paths pass through the "room acoustics" box. This is to emphasize that room size and shape, and the amount of sound absorption of the room surfaces and furnishings, influence the sound level. As noted by Mr. Wells, a noise problem is rarely solved by increasing the room absorption. Successful noise control is more often achieved by modifying one or several of the paths of transmission shown in Fig. 1.

Noise in Air Distribution Systems

The airborne noise generated and transmitted by air distribution systems may be one of the major sources of noise within buildings. As such, it is important that these systems be designed to provide a satisfactory acoustic environment in addition to their primary function of providing a suitable thermal environment. The remainder of this report considers the sources of noise in air distribution systems and some of the factors to be considered in acoustic design.

Noise Criteria Establish Design Goal

When establishing the acoustic design goal or permissible noise level for an air conditioned space, the use for which the space is intended and its background noise level must be considered. In addition, the quality of the noise must also be considered. Acoustical engineers have evaluated various types of spaces to determine average acceptable noise levels. The method of presenting the criteria differ somewhat and the purpose here is to review the methods that have been proposed and that are in use.

It is generally agreed that the single number sound level read on the A scale of a sound level meter is not an adequate criterion for good acoustic design. However, the single number is suitable for determining the acceptability of the

noise in a space, as was[3] pointed out by C. M. Ashley in a recent paper. Acceptable sound levels for various types of spaces selected from the data presented by Mr. Ashley are listed in Table 1. These criteria can be used as an expedient means of determining the acceptability of noise levels in a space prior to occupancy. This eliminates the need for a complete and time consuming octave band analysis to determine whether the equipment installed and the installation satisfy the design noise criterion. Further analysis of problem areas discovered in this way can be made to determine the source of undesirable noise.

One noise criterion suitable for design is based upon the sound pressure levels that cause speech interference and the permissible rise of loudness above the background noise. This criterion was developed[4] by L. L. Beranek as a result of studies of a number of types of space. Sound pressure levels[4,5] are given for each octave band in this criterion and these are listed in Table 2. The types of space for which the various noise criteria are applicable are given in Table 3. To select a design goal one must refer to Table 3 to determine which NC criterion is applicable to the space being conditioned. Permissible sound pressure levels are then found in Table 2.

More recently H. C. Hardy in a paper presented at the BRI conference has proposed a method[6] of establishing permissible noise levels on the basis of total loudness. It will be remembered that loudness ranks sounds on a relative basis such that a sound with a loudness of two is heard twice as loud as a sound with a loudness of one. Thus, sones are easily understood and grasped by the user. They are not abstract like decibels. A number of different types of environments have been evaluated and suggested loudness limits have been recommended for them by Dr. Hardy. Some of the proposed limits presented in his paper are listed in Table 4.

The limits given in Table 4 represent both maximum and minimum limits for comfort. Spaces with loudness less than that given for the very quiet condition will be uncomfortably quiet because speech and other intermittent noises will become annoying. A design within the limits will tend to mask these undesirable sounds.

According to Dr. Hardy total loudness alone is not a sufficient criterion upon which to base a

TABLE 1 — RECOMMENDED NOISE LEVELS for several types of space based[a] upon the A scale or 40 db network of the sound level meter

Space type	Room noise level, dba
Conference rooms for 50, executive offices, courtrooms	35
Schoolrooms, churches, motion picture theaters	35-40
Apartments, hotels, conference rooms for 20, "quiet" offices	40
Hospitals, libraries	40-45
Small offices	45
Medium and large offices, banks upper floors of department stores	50
Restaurants, cafeterias, grilles, first floor of department store	55
Offices (general, secretarial, accounting)	60

[a]*Data[3] from "Criteria for Room Noise from Air Conditioning" by C. M. Ashley, ASHAE* Transactions, *Vol.* 63, 1957.

TABLE 2 — NOISE CRITERIA given here are based upon speech interference levels[a]. Sound pressure levels in decibels (re 0.0002 microbar) for each octave band are listed

	Octave band, cps								
NC[b] Designation	20 to 75	75 to 150	150 to 300	300 to 600	600 to 1200	1200 to 2400	2400 to 4800	4800 to 10,000	Total[c] loudness, sones
NC 20	54	43	35	28	23	20	17	16	1.0
NC 30	60	51	43	37	32	30	28	27	2.5
NC 40	66	59	52	46	42	40	38	37	5.2
NC 50	73	66	60	55	52	50	48	47	10.3
NC 60	79	73	68	64	62	60	58	57	19.4
NC 70	85	80	76	73	71	70	69	68	37.7

[a]*Data from Fig.* 3, *Chapter* 25, Heating Ventilating Air Conditioning Guide 1959. Used by permission.
[b]*Linear interpolation is precise for intermediate criteria.*
[c]*Total loudness is calculated as the sum of the maximum loudness in one band and* 0.3 *of the sum of the loudness in the other* 7 *bands.*

TABLE 3 — NOISE CRITERIA in Table 2 are recommended[a] for use in types of space listed here

Type of space	Recommended noise criterion
Music rooms, conference rooms for 50, school rooms[b]	NC 25
Apartments, hotels, assembly halls with amplification	NC 25-30
Conference rooms for 20, motion picture theaters hospitals, churches, libraries	NC 30
Small private offices	NC 30-35
Offices (general, secretarial, accounting)	NC 50

[a]*Data from Table* 1, *Chapter* 25, Heating Ventilating Air Conditioning Guide 1959. *Used by permission.*
[b]*Criterion for school rooms is to be increased in the near future.*

TABLE 4 — TOTAL LOUDNESS limits recommended[a] for noise from heating and air conditioning equipment in selected spaces are listed here

	Total loudness, sones		
Type of space	Very quiet	Quiet	Slightly noisy
Concert halls	0.8	1	1.5
Executive offices	1.5	2	3
School classrooms	1.5	2.5	4
Ball rooms	1.5	3	5
Court rooms	2	3	4
Drafting rooms	2	4	8
Hotel lobbies	2	4	8

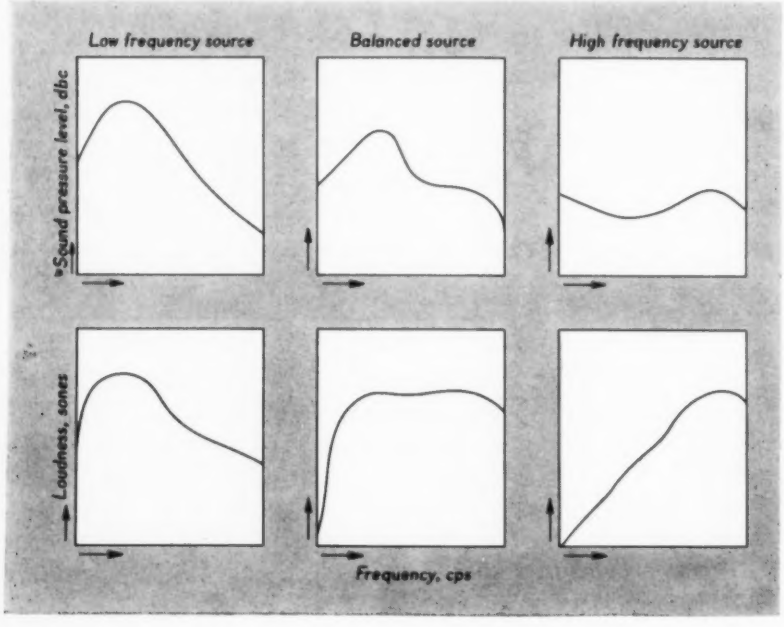
[a]*Data from "Ventilation System Noise" by H. C. Hardy, Building Research Institute Conference on Noise Control in Buildings.*

design goal. The reason for this is illustrated in Fig. 2. The sound pressure levels and loudness for three types of sound sources are illustrated in the figure. The three sounds have approximately the same total loudness but only the balanced source noise is pleasing to the ear. The low frequency noise can be characterized as a roar and the high frequency noise as a hiss, such as that from an air jet. Thus, in addition to specifying total loudness, equal loudness in all bands must also be specified.

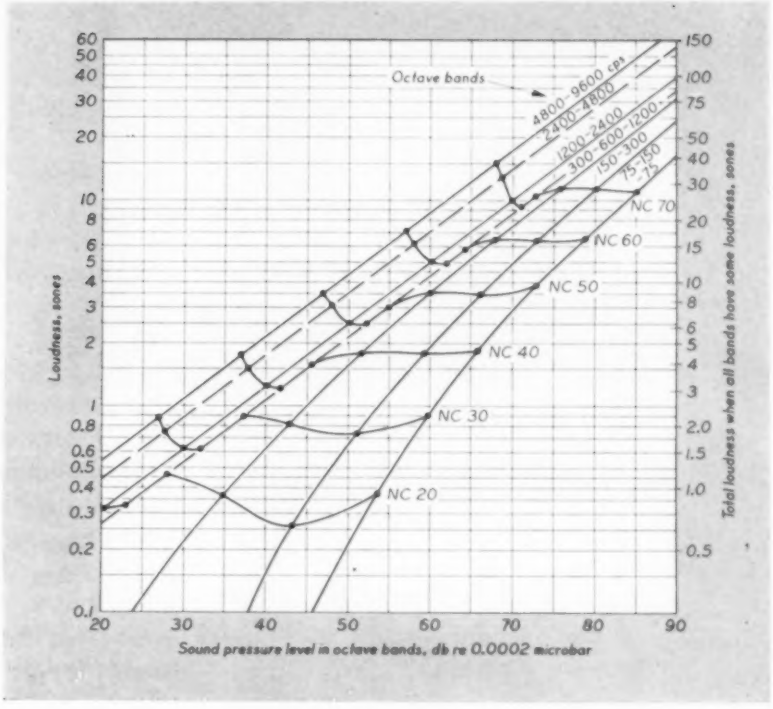
Quality also depends upon the continuity of the noise. Intermittent noises (such as that from office machines) and noises that vary in loudness reduce quality and are more annoying than those which are steady and have a somewhat higher loudness. A noise of good quality may be of help in masking undesirable environmental noise.

The octave band sound pressure levels corresponding to Dr. Hardy's criteria can be obtained from a set of curves such as that shown in Fig. 3. This type of graph was presented[7] by R. A. Gerlitz for use in a design procedure for selecting wall mounted ventilating fans. The basic data relating sones, octave band frequency, and sound pressure levels was presented[8] by S. S. Stevens. The right hand ordinate shows the total loudness when the loudness in each band is equal to that of the corresponding left hand ordinate. The right hand ordinate corresponds to the total loudness limits recommended by Dr. Hardy. Design sound pressure levels for this criterion are obtained from the intersections of a horizontal line at the desired total loudness and the octave band frequency curves.

The NC data from Table 2 have been plotted in Fig. 3 for comparison. It will be noted that the NC curves are approximately of equal loudness in all bands except the three in the 600 to 4800 cps frequency range. The loudness is reduced in these bands to make speech communication less difficult. Comparison of the two criteria shows that only small differences exist. For example, the NC 30-35 criterion is recommended for small private offices. The least noisy condition, NC 30, compares with the quiet condition of 2 sones for executive offices from Table 4. The differences between the permissible sound pressure levels for the NC 30 and the 2 sone limit are in the region of speech interference where the maximum difference amounts to about 4 dbc. Since the criteria are based upon surveys of background noise levels and subjective response to noise in various environments, some differences in the magnitude of permissible levels can be expected. The use of loudness as a criterion as mentioned above offers the possibility of ranking and selecting the criteria on a relative basis. Total loudness can be calculated for the NC criteria as has been done in Table 2. It will be noted that each succeeding criterion is approximately twice as loud as the



2 QUALITY OF SOUND as well as its loudness must be considered when determining acceptability of room noise levels. The three sounds illustrated have approximately the same total loudness as indicated by the curves in the lower portion of the figure. However, only the balanced noise (center) is pleasing to the ear. The low frequency source (left) would be heard as a rumble because the loudness is concentrated in the low frequency bands. The high frequency source (right) would be heard as a hiss because of excessive loudness in the high frequency bands



3 NOISE CRITERIA are shown here as a function of loudness in sones, sound pressure level in dbc, and frequency in cps. NC criteria are based upon speech interference levels as indicated by reduced loudness in the frequency range from 600 to 4800 cps. To determine sound pressure levels corresponding to loudness limits for environments listed in Table 4, curve is entered at right at permissible loudness limit. Sound pressure levels are read from the bottom

one preceding it. Thus, the relative loudness of the NC criteria can be determined if it is convenient to do so for establishing design goals.

Permissible limits of total loudness for many other types of space have been established by Dr. Hardy and will soon be available.

What to Consider in Acoustic Design

Having selected the goal for the acoustic design of an air distribution system, each source of noise and each attenuation in the system must be accounted for to determine whether the design goal has been met or what modifications must be made to the acoustic path to achieve the desired goal. Some of the factors to consider are outlined in the following discussion.

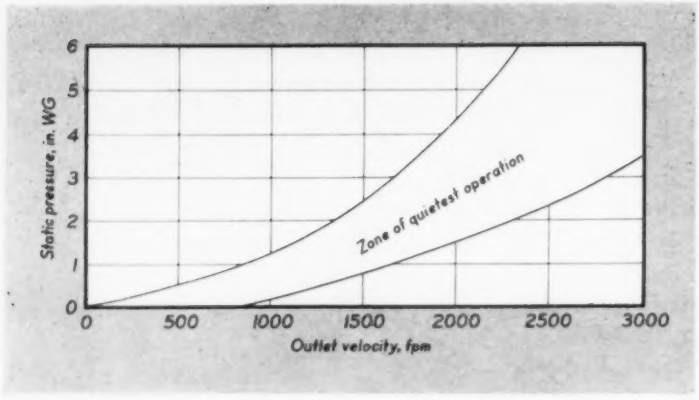
Noise of Fan Important

The fan is one of the principal sources of noise in an air distribution system. Thus, acoustic design must begin at this point.

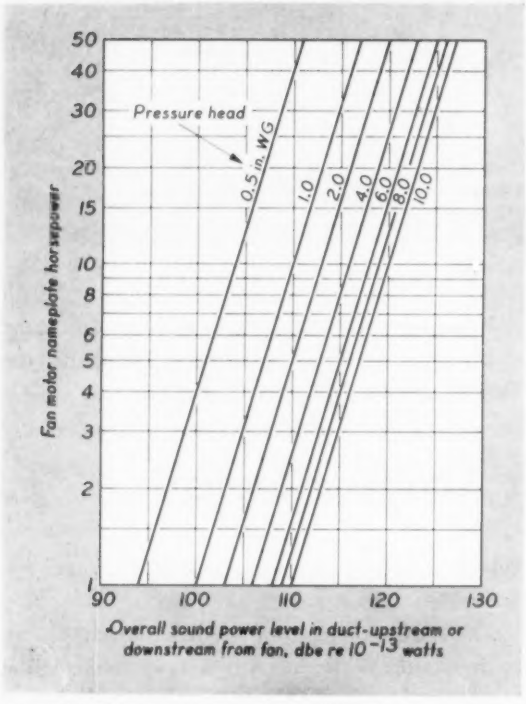
The first consideration is the selection of a fan that has a minimum noise output at the design conditions of air flow rate and static pressure. A suggested guide for selecting a fan on the basis of static pressure and outlet velocity was presented[5] recently by W. E. Tracy. Limits of outlet velocity for various static pressures for quiet operation are shown in Fig. 4.

The noise generated by the fan must be known to predict the noise that will be transmitted to the conditioned space. As mentioned earlier, for acoustic design purposes, the sound power output in watts or sound power level in decibels in each octave band must be known. The single reading of sound level at a prescribed distance is not considered satisfactory. This is recognized by the fan industry and a code is in preparation for evaluating[6] the necessary design data.

It is most desirable to use acoustic power data provided by the fan manufacturer for design purposes when it is available. If this information cannot be obtained, Fig. 5 and Table 5 will be useful in estimating the sound power level in each octave band. Fig. 5 is based upon tests of a number of fans and presents graphically the solution of the



4 FAN SELECTION within limits of static pressure outlet velocity shown here will insure maximum efficiency and minimum noise



5 OVERALL sound power level of fan in duct upstream or downstream from fan may be approximated from this graph knowing rated motor horsepower and pressure head on fan when manufacturer's data are not available. Motor operation near rated value is assumed. Octave band power levels are obtained by adding corrections given in Table 5

empirical equation for total sound power level determined[10,11] by Dr. Beranek, et al and C. H. Allen. The equation is as follows:

$$PWL = 100 + 10 \log (hp) + 10 \log p$$

where:

hp = nameplate horsepower of fan motor assuming motor is operating near its rating

p = pressure head, in. WG

The overall power level determined by this means will be within ± 4 dbe of the true value.

To obtain the sound power level in each octave band add algebraically the decibels listed in Table 5. This procedure provides the sound power level in each octave band that exists in a duct either upstream or downstream from the fan. The overall power levels and, thus, the octave band levels obtained from this equation will generally be high, especially in the low frequency bands.

Duct System Attenuation

The duct system is the path of transmission that carries the airborne sound from the fan to the conditioned space. Consequently, the acoustic characteristics of this path must be considered in design. Elbows, straight duct, and division of the flow from the fan into branches, reduce or attenuate the sound power of the fan.

When a main stream is divided into a number of branches, the sound power of the stream divides[8] approximately as the ratio of the area of the branch under consideration to the total area of all branches taken from the main duct. If design calculations were made on the basis of sound power, the acoustic power transmitted to the branch would be expressed as a decimal fraction. Thus, if the ratio of branch area to the sum of the

TABLE 5 — OCTAVE BAND POWER LEVELS of fans are obtained by adding algebraically the overall power level[a] found from Fig. 5 and the decibels listed here

	Octave band, cps							
Type of fan	20 to 75	75 to 150	150 to 300	300 to 600	600 to 1200	1200 to 2400	2400 to 4800	4800 to 10,000
Centrifugal	−1	−6	−11	−16	−21	−26	−31	−36
Axial flow	−9	−7	− 6	− 6	− 7	−10	−13	−17

[a]*Data from* ACOUSTICS *by L. L. Beranek. Copyright, 1954. McGraw-Hill Book Co. Used by permission.*

area of all branches is 0.25, approximately one-fourth of the sound power would be transmitted to the branch. When using sound power level, the attenuation must be expressed in decibel form on a logarithmic scale.

The attenuation in decibels (dbe) due to branching can be found from Fig. 6. For example, if four branches of equal areas are taken from a main, the attenuation at each branch (ratio = 0.25) is 6 dbe. This attenuation must be considered at each branch along the acoustic path being considered.

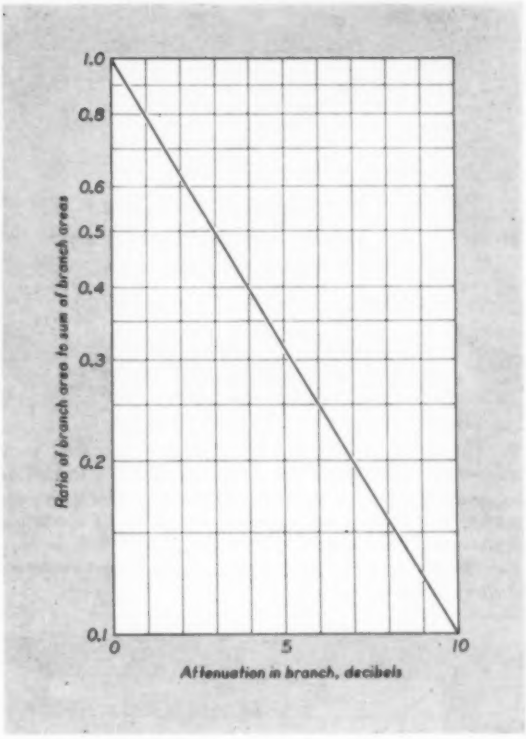
Only limited attenuation data is available for elbows. In general, this data indicates that attenuation varies with duct system length, the number of elbows and how close they are to each other, and the nature of the duct surface — whether lined or unlined. The data available do not provide sufficient information to predict the extent to which these various factors will affect the attenuation. However, it should be remembered that some attenuation will be obtained because of elbows and that duct lining will be more effective when it is located at turns.

The attenuation of sound in straight unlined ducts was recently reported[12] with the exterior duct surfaces bare and also covered with insulations of different densities. The data for bare ducts indicates attenuation in each octave band in the amounts given in Table 6 for two duct sizes. Similar data for larger ducts is not available. However, an earlier study[13] indicated that the attenuation in a 12 in. × 36 in. duct was negligible except at low frequencies. In the same study, attenuation in a 6 in. × 6 in. duct was approximately the same as the values given in Table 6. This suggests that in ducts larger than 12 in. × 36 in. the attenuation should be reduced or may be neglected without introducing appreciable errors. Such errors, if any, will result in a conservative design.

TABLE 6 — SOUND ATTENUATIONS in straight unlined ducts are listed here in decibels per foot for octave bands*

Duct size, in.	Octave band, cps							
	20 to 75	75 to 150	150 to 300	300 to 600	600 to 1200	1200 to 2400	2400 to 4800	4800 to 10,000
12 x 12	0.26	0.26	0.20	0.16	0.08	0.12	0.12	0.16
12 x 24	0.30	0.36	0.16	0.06	0.12	0.12	0.12	0.16

*Data from "Sound Attenuation in Straight Ventilation Ducting", J. B. Chaddock, Refrigerating Engineering, January 1959.

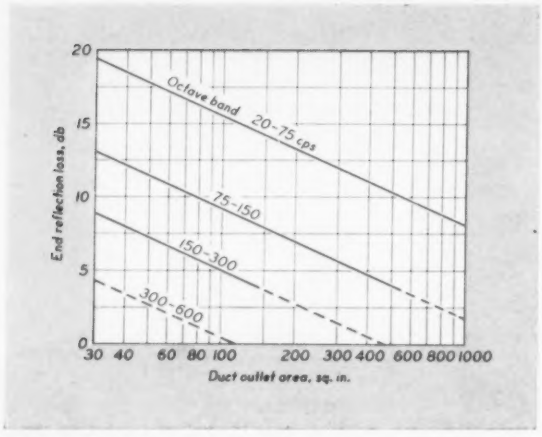


6 ATTENUATION due to division of air flow depends upon ratio of branch area to the sum of the areas of all branches taken from a trunk duct in the amounts shown here. The attenuation due to branching must be considered each time the flow is divided

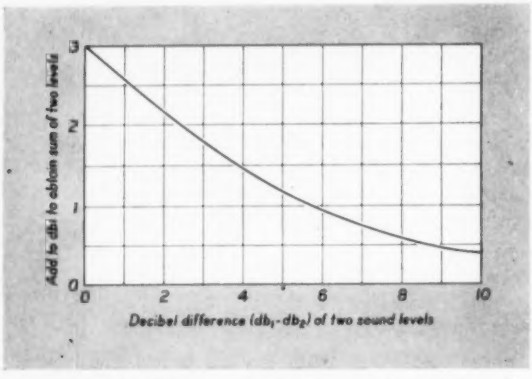
Thermally insulating the exterior surfaces of ducts increased[12] the attenuation in the low frequency bands. A light weight wrapping of glass fiber insulation increases attenuation over that for a bare duct by about 0.1 db per ft in the frequency range from 20 to 600 cps. The use of semi-rigid insulation board increases the attenuation an average of 0.4 db per ft in the frequency range from 20 to 150 cps over that for the uninsulated duct.

Loss at Duct Outlet

When noise is transmitted down a duct, all of the sound power reaching the outlet is not radiated to the conditioned space. A part of the power is reflected[5] back into the duct. This effect is most pronounced in the low frequency octave bands with duct outlet areas usually encountered in heating and air conditioning. The attenuation or "end reflection loss" at the duct outlet can be obtained from Fig. 7 for the condition that the duct end is flush with the wall surface. The dash lines



7 REFLECTION of sound back into duct attenuates noise transmitted from the fan and other sources in a system. This is especially true in the low frequency octave bands for branch duct outlet areas commonly found in air conditioning systems. Curves apply when outlet is flush with surface. Data based upon Fig. 11, Chapter 25, *Heating Ventilating Air Conditioning Guide* 1959



8 TWO SOUNDS of unequal level may be added by determining difference in levels and then adding the amount shown above to the larger of the two levels

represent areas for which the attenuation in Fig. 7 deviates from the theory given in Reference 5. The attenuations in Fig. 7 are on the conservative side in this region. It should be noted that the end reflection loss depends upon the ability of the duct to dissipate the reflected sound energy. For this reason, this attenuation should be neglected in very short ducts. In lined ducts, the actual attenuation may be greater than that indicated by the curves.

Other Sources of Noise

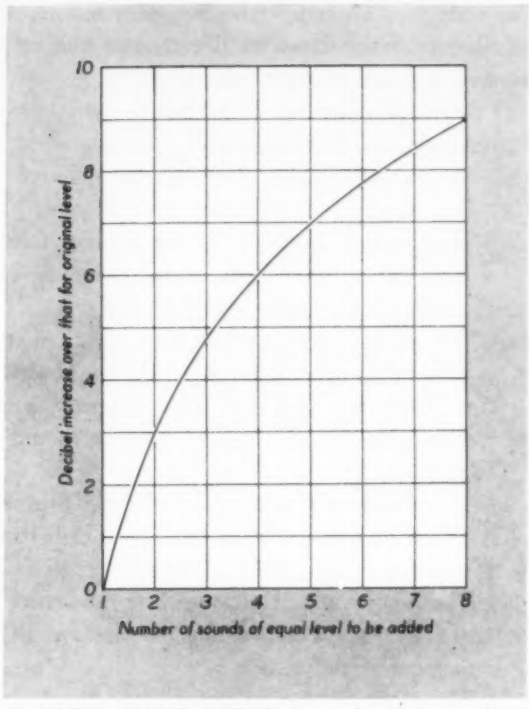
Other sources of noise that must be considered include pressure reducing dampers, mixing units in dual-duct systems, grilles, and diffusers. Generalized noise performance data for these components are not presently available. Manufacturer's data for specific units should be used when it is available. The increase in sound power level due to the addition of these power levels when known can be found from Fig. 8. For example, if the sound power levels in a particular octave band are 85 dbe at the duct outlet and 80 dbe for the grille, the difference in these two levels is 5 db and the amount to be added to the larger level is found in Fig. 6 as 1 db. Thus, the total sound power level of the combination is 85 + 1 or 86 dbe. It can be seen in Fig. 8 that the smaller power level can be neglected if the difference between two levels being added is greater than 5 dbe.

When more than one grille or diffuser is required in a room, the sum of the sound power levels of the total number used must be considered. Fig. 9 may be useful in determining the sum of the levels when all grilles have the same octave band power levels. For example, four grilles with an 80 dbe level in a particular octave band will have a resultant power level of 86 dbe.

Selection of the air distribution outlets must take into consideration that the noise generated by the outlet is attenuated only by the absorption in the conditioned space. That is, if the sound power level of the outlet produces a sound pressure level greater than the design criterion, another outlet selection must be made. The sum of the attenuated noise transmitted to the outlet through the ducts and the noise generated by the outlet must produce sound pressure levels equal to or less than the criterion. From Figs. 8 and 9 three of the several ways in which this can be accomplished are:

1) Selecting the outlet to produce a sound pressure level 3 dbc below the criterion and attenuating the transmitted noise to the same level.
2) Selecting the outlet to produce a sound pressure level equal to the criterion and attenuating the transmitted noise to 5 dbc or more below the criterion.
3) Selecting the outlet to produce a sound pressure level 5 dbc or more below the criterion and attenuating the transmitted noise to equal the criterion.

Other combinations providing the desired total power level at the outlet face can be determined from Fig. 8. The final outlet selection must consider principles of good air distribution as well as the limits imposed by the noise criterion.



9 TOTAL SOUND POWER level of several sounds of equal level may be obtained by adding amount indicated above for the number of sounds being added. This may be useful when several grilles or diffusers are required to condition a space or when several fans are installed to ventilate a space

Conversion of Power to Pressure

Following the steps outlined above, the sound power level in each octave band at the grille or diffuser face is determined. This must then be converted to sound pressure level at the point the listener hears the noise. As indicated in Fig. 1, the acoustic characteristics of the room determine in part what this pressure level will be. Also, the pressure level will vary with distance from the outlet due to attenuation within the space.

The amount of sound energy that will be absorbed by the surfaces of a room depend upon the character of the room surfaces. The effective absorption can be calculated by the relationship:

$$E = \alpha S/(1-\alpha)$$

where:

E = effective absorption, sq ft
S = total surface area of room boundary, sq ft
α = average absorption coefficient of room surfaces

Values of absorption coefficients for specific materials may be obtained[14] and the effective absorption calculated for a particular room. Average values of effective absorption for various acoustic environments are given in Fig. 10 from Reference 15. Knowing the type of space and room volume, the effective absorption can be read from the curves. These values should be considered only as a guide and judgment should be exercised in their use as absorption varies with frequency. Because of this, attenuation in the room at low frequencies may be somewhat less than that for the average absorption found in Fig. 10.

Having selected the effective absorption from Fig. 10, the sound pressure level in the room at various points can be determined from the power level at the grille face. In general, an air distribution outlet can be considered as a small nondirectional sound source. The relationship[16] of sound power level (PWL) and sound pressure level (L_p) for this condition is:

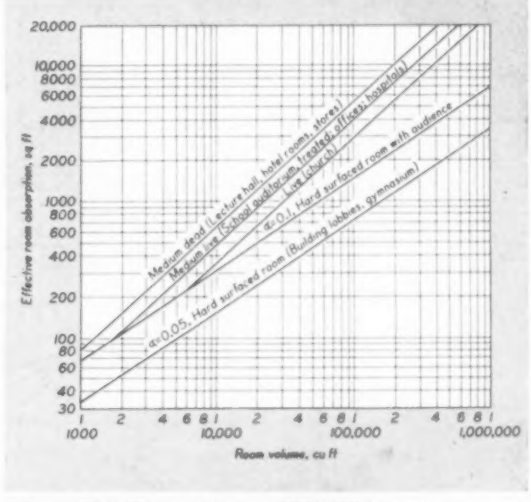
$$L_p = \text{PWL} + 10 \log [(Q/4\pi r^2) + (4/E)] + 0.5$$

where:

Q = directivity factor
r = distance from sound source, ft
E = effective absorption, sq ft

The solution of the last two terms of this formula for values of r and E is presented graphically as relative sound pressure level in Fig. 11 for $Q = 2$. This is the condition when a source located in a plane surface radiates sound into a hemispherical space. Air distribution outlets are basically sources of this kind.

Sound, especially at high frequency, may be beamed from the supply outlet to nearby listeners.



10 EFFECTIVE SOUND ABSORPTION of room surfaces may be obtained from these curves. Select curve that is representative of characteristics of room being conditioned

The directivity factor (Q) may have values as high[5] as 8 when the listener is directly in front of the supply outlet. This would result in a maximum error of 6 dbc at distances within the direct sound field, which is indicated by the sloping portion of the relative pressure level curves. Since good air distribution principles preclude the possibility of having the listener located immediately in front of the supply outlet, the directional effects will usually be less and will amount to 3 dbc or less and in most cases may be neglected. In large rooms with systems employing large supply outlets and with the occupants located near the outlets, the directivity factor should be considered. This may be obtained from Reference 5.

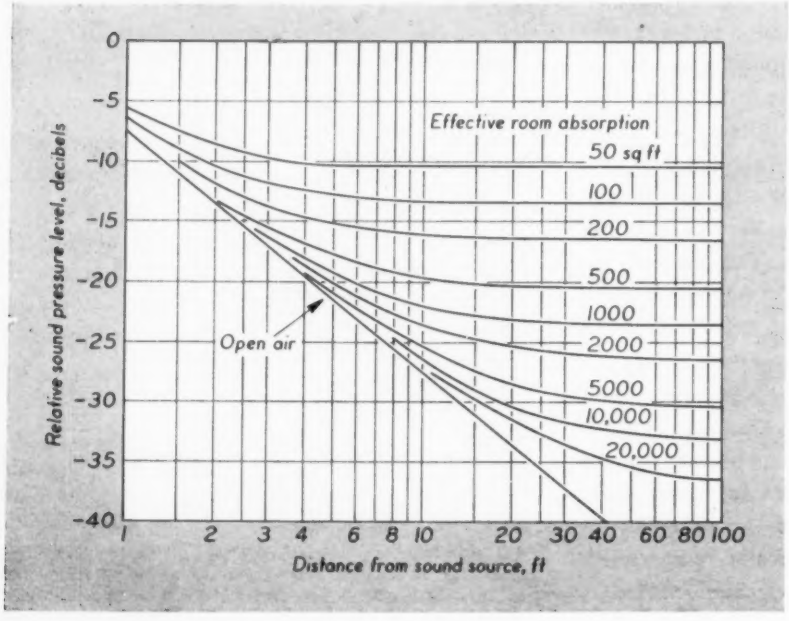
In most instances, the occupants will be located in the reverberant sound field — the flat portion of the relative pressure level curves — and directivity need not be considered as the direct sound from the outlet does not predominate. In this region, reflections from the room surfaces determine the sound pressure level.

How to Tabulate Data

At this point, if the procedures outlined above are followed, enough data have been collected to establish whether the sound pressure levels in each octave band or the total loudness satisfy the design criteria for the conditioned space under consideration. To review the design procedure, a tabulation of the data would consist of the following for each octave band:

1) Sound power level of the fan.
2) Attenuation due to branching.
3) Natural attenuation in the ducts.
4) End reflection loss at outlet.
5) The sum of items 2, 3, and 4 subtracted from item 1 provide the sound power from the fan at the supply outlet.
6) The sound power level of the supply outlet or outlets as the case may be, and the known sound power level of other necessary air distribution devices such as dampers, mixing boxes, etc.
7) The logarithmic sum of items 5 and 6 provide the sound power level at the face of the outlet.
8) The relative sound pressure level at the listener's location considering the effective absorption of the room.
9) The algebraic sum of items 7 and 8, which provides the sound pressure level at the listener's position.
10) The design criteria sound pressure level.
11) The additional attenuation needed, if any, by subtracting item 10 from item 9. Positive numbers indicate the attenuation needed.

In general, in air distribution systems the noise in the low frequency bands will be most trouble-



11 SOUND POWER LEVEL at face of air distribution outlet must be converted to sound pressure level at listener's location in room to determine compliance with design criteria. The attenuation due to distance from outlet and characteristics of the room may be found above. Relative sound pressure level is added algebraically to sound power level at the face of the air distribution outlets

some. First of all, a fan produces a large portion of its sound energy in these bands. Also, high frequency sound is more easily attenuated than low frequency sound as will be seen later.

In contrast with designing for adequate air flow to all spaces in which the longest run is usually critical, in designing for acceptable sound levels the shortest run is usually critical. Thus, the initial calculations for acoustic design should consider the rooms closest to the fan. This may not be the case, however, when remote rooms have more severe design criteria than those near the fan.

How To Meet Design Criteria

If additional attenuation is needed to meet the design criteria as indicated by item 11 above, it may be accomplished in several ways. Two methods will be considered here.

Attenuation by Lining Ducts

Lining the ducts with a sound absorbing material is one means of attenuating the noise in air distribution systems. The attenuation that may be obtained in this way can be approximated for ducts with aspect ratios no greater than two to one by an empirical[17] formula, which is as follows:

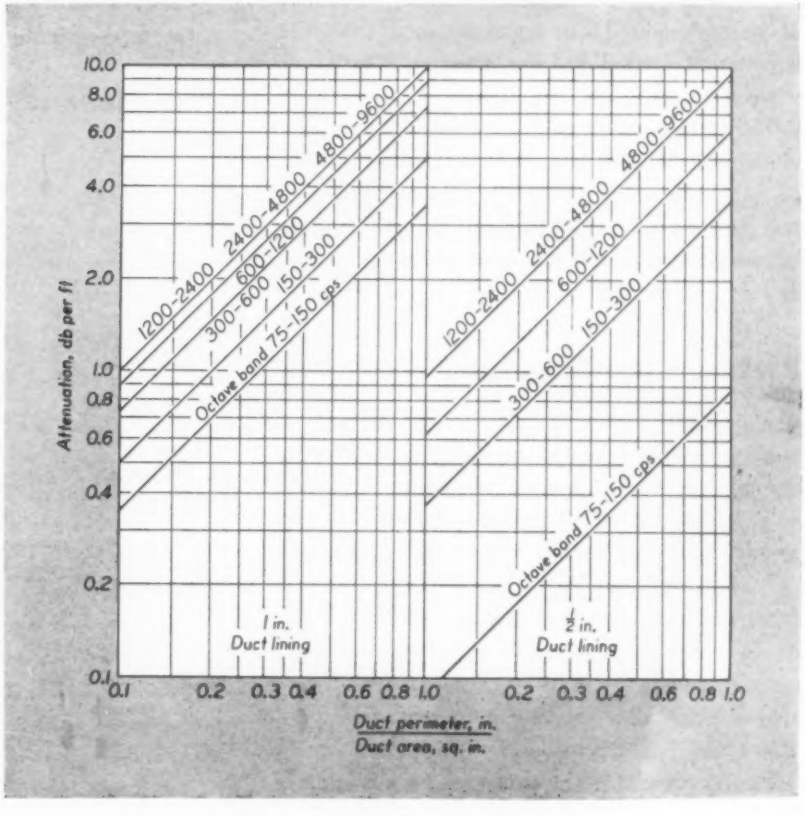
$$R = 12.6(l)(P/A)\alpha^{1.4}$$

where:

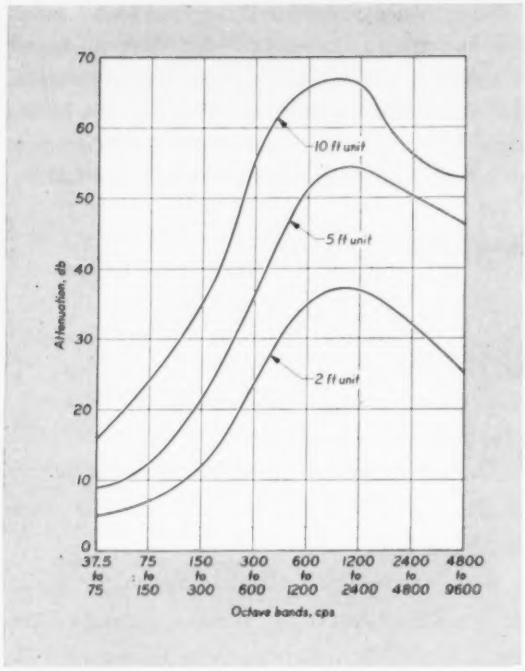
R = attenuation, db
l = length of duct, ft
P = perimeter of duct, in.
A = cross-sectional area of duct, sq in.
α = absorption coefficient of lining

The absorption coefficient is a function of frequency and values must be obtained from manufacturer's data.

A graphic solution of this equation for available glass fiber duct lining in two thicknesses is given in Fig. 12 from Reference 15. Entering the figure with the P/A ratio for the ducts in the acoustic path, the attenuation per foot in each octave band may be determined. The total attenuation can then be calculated from the length of each duct size and



12 ATTENUATION obtained with glass fiber duct lining is given here for two different thickness of insulation for each octave band. Attenuation in the octave band below 75 cps is not increased by duct lining and values for bare duct may be used. Manufacturer's data should be used whenever available as absorption varies with type of material, density, frequency, etc



13 ATTENUATION of packaged sound attenuators may be similar to rating data shown here. Note that attenuation is greatest in high frequency octave bands and especially those in which speech interference may occur. Manufacturer's ratings must always be used when selecting package attenuators

the respective attenuations. Conversely, the length of lining required can be determined from the attenuation needed and the attenuation per foot when the duct is of constant size.

The dual function of duct lining—that of providing both thermal and sound insulation—should be noted. In many situations, thermal insulation may be necessary. In such cases, duct lining may be the most economical means of obtaining the desired end result.

Package Sound Attenuators

A package attenuator that provides the desired noise reduction may also be used to satisfy the design criterion. Noise attenuation units should be carefully selected to be sure that the desired amount of noise reduction is obtained. Package units consist basically of highly absorbent passages and sometimes incorporate special features to increase attenuation in the low frequency octave bands.

The permissible increase in system static pressure must also be considered in the selection.

Rating curves for one package unit available in a number of lengths are shown in Fig. 13. It will be noted that the attenuation in the high frequency octave bands is several times that in the low frequency bands. These curves should not be used for design purposes. Selection should be made from manufacturer's data.

Owner Satisfaction Most Important

The sound power level concept has been used in the design procedure outlined in this report. Another approach[6] for which data are now being assembled utilizes sound power to determine the sound energy radiated from the supply outlets of an air distribution system. The elements of design are the same. But, the mathematical manipulations differ because sound power may be added algebraically. Attenuations are given in percent of power transmitted. The end result is the same and the success of any acoustic design is measured not by whether design goals have been met, but by user satisfaction.

[The editors wish to acknowledge the advice of the acoustic consultants and the engineers who cooperated by reviewing this report and the various organizations who permitted the use of data compiled herein.]

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THE ST. LAWRENCE SEAWAY AUTHORITY BUILDING

Cornwall, Ontario

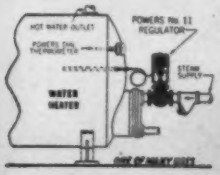
Architects: GORDON S. ADAMSON & ASSOCIATES, Toronto
Consulting Engineers: R. P. ALLSOP & ASSOCIATES LTD., Toronto
Mechanical Contractor: CANADIAN COMSTOCK CO. LTD., Ottawa

Powers Temperature Control Here Includes Solar Compensator System

The direct radiation is regulated by a Powers MASTROL System. Controlled conditioned air for intermediate floors is supplied by a central fan system. On the top floor a central supply unit with unit conditioners for individual spaces, is equipped with a solar compensator system. It automatically changes the system from heating to cooling at the optimum condition dictated by outdoor temperature and sun intensity.

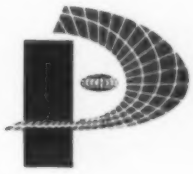
Photo below shows Powers Control Center with solar compensator adjustments, gauges, relays, switches and thermometers to indicate operation of the air conditioned zones on the executive floor.

(D15)



Powers No. 11 Temperature Regulator used here for hot water storage heater stops hot water complaints and saves fuel.

In the headquarters of the
"World's Largest Controlled Deep Water Navigation System"



POWERS Regulates the Climate of Progress

Once again in another important building a Powers Quality System of Air Conditioning Control provides the utmost in comfort, fuel economy and year after year dependable operation.

Unique In World History

The new St. Lawrence Seaway is an outstanding example of good neighborliness between two nations. Working efficiently together Canada and the United States have expanded an inland sea to strengthen the defense and economy of each nation.

The Seaway begins and ends in Canadian territory. Two-thirds of its cost was paid by Canada and from the tolls collected at the headquarters in Cornwall two-thirds is paid into the Canadian Seaway account, and one-third is paid to the United States Seaway headquarters at Massena, N. Y.

For your new building—remember that successful operation of heating or air conditioning can only be as good as the control system. Make sure you get the best. Insist on a time-proven Powers Control System.

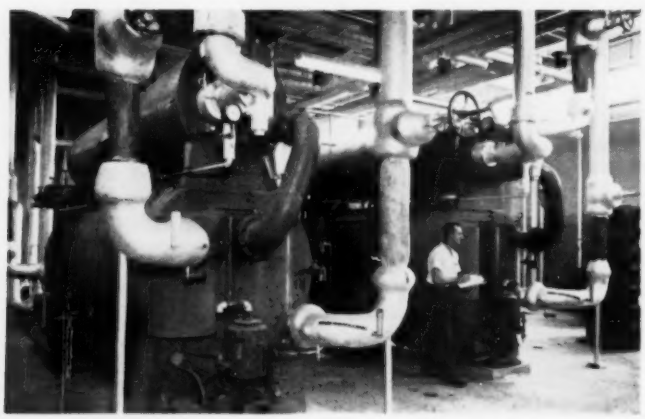
THE POWERS REGULATOR CO.

SKOKIE, ILL. | *Offices in 85 cities in U.S.A. and Canada* | *See your Phone Book*

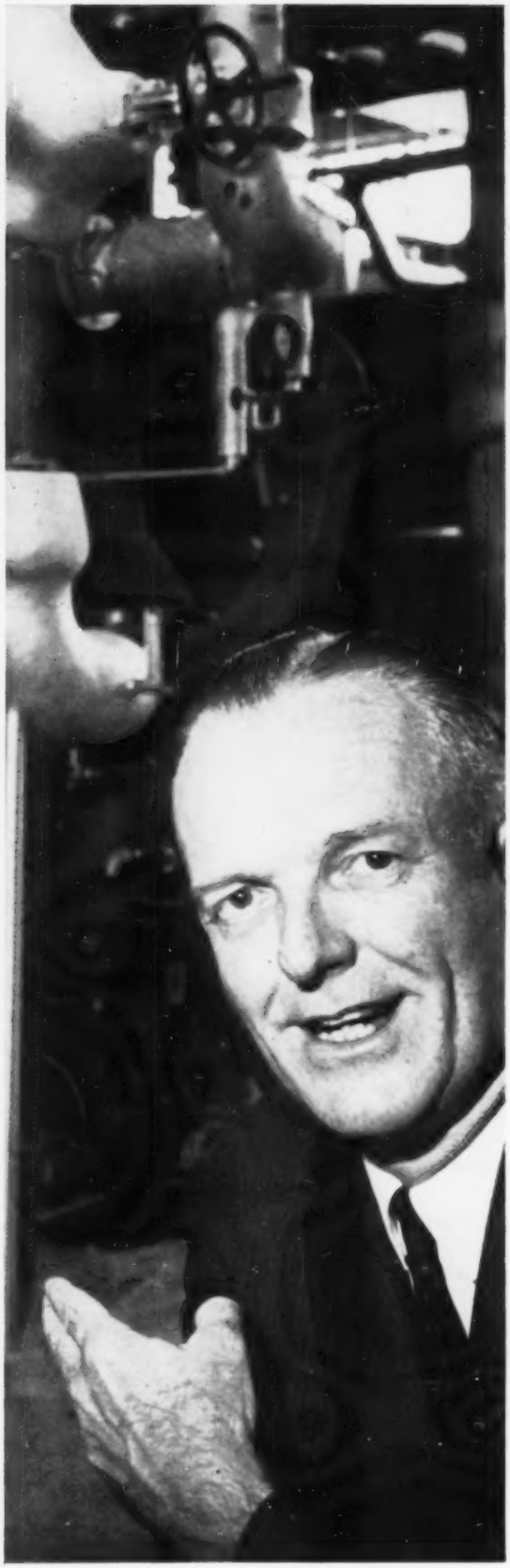
Automatic Temperature and Humidity Control Since 1891

NO SUMMERTIME SLUMP With gas as the boiler fuel and York machines, the switch to summer cooling was no problem. Operating costs are low, too, thanks to Gas.

LATEST IN COOLING Gas operated York machines feature the use of tap water as refrigerant and lithium bromide as absorbent, one of the most efficient, practical refrigeration cycles developed so far. Machines start and stop automatically.



THE UTMOST IN FLEXIBILITY The units are cross-connected so that each operates independently if necessary.



MAINTENANCE COSTS TO DATE—ZERO! The Allen Company uses two York machines—a 230-ton unit serving 45,000 sq. ft. of office and cafeteria space, a 170-ton unit for process water cooling. Three small pumps and motors are the only moving parts in the entire system.

"with **YORK GAS** *air conditioning our boilers keep us cool all summer"*

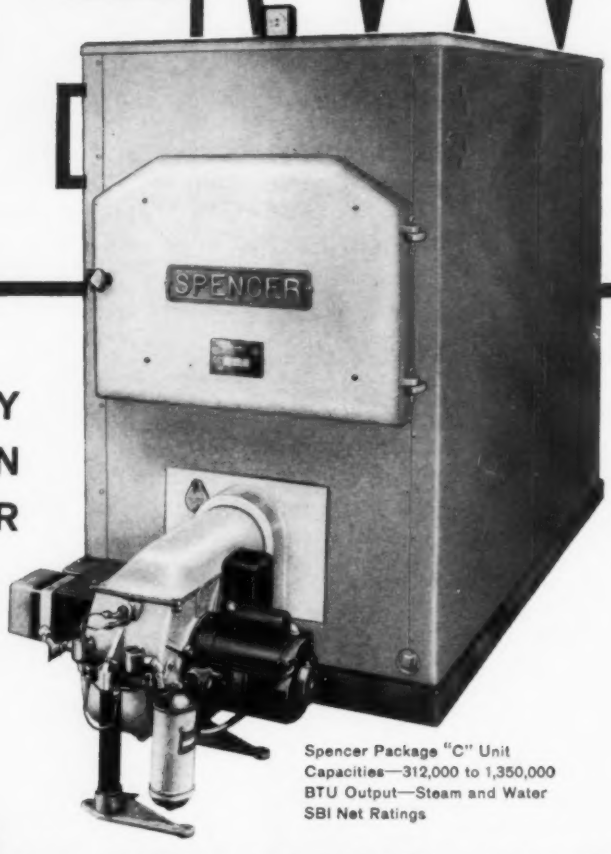
"With our boilers sized for a winter load, we were naturally oversized for the summer months. But York's gas-operated Lithium Bromide absorption water chillers permit us to make efficient use of part of this steam capacity to cool," says Mr. M. J. Mather, President of the Allen Manufacturing Company, makers of hex-socket screws.

The York Lithium Bromide system eliminates the need for huge compressors found in other types of cooling equipment . . . which brings down the original cost considerably. And with gas the boiler fuel, you make year-round use of an otherwise wasted source of power *at rock bottom costs.* In addition, York machines are noiseless, lightweight, compact—easy to install and readily adaptable to almost any plant layout.

Find out how your present heating system can pay off for you all year 'round with gas-operated York automatic water chilling units. Call your local gas company or write to the York Corporation, Subsidiary of Borg-Warner Corporation, York, Pennsylvania. *American Gas Association.*

NEW

NO REFRACTORY COMBUSTION CHAMBER



Spencer Package "C" Unit
Capacities—312,000 to 1,350,000
BTU Output—Steam and Water
SBI Net Ratings

SPENCER OIL-FIRED PACKAGE "C" UNIT

featuring . . . **NO REFRACTORY COMBUSTION CHAMBER!** None to buy, none to build . . . merely locate precast refractory base, slide boiler shell into place, assemble jacket, and position burner unit . . . turn it on, and that's it!

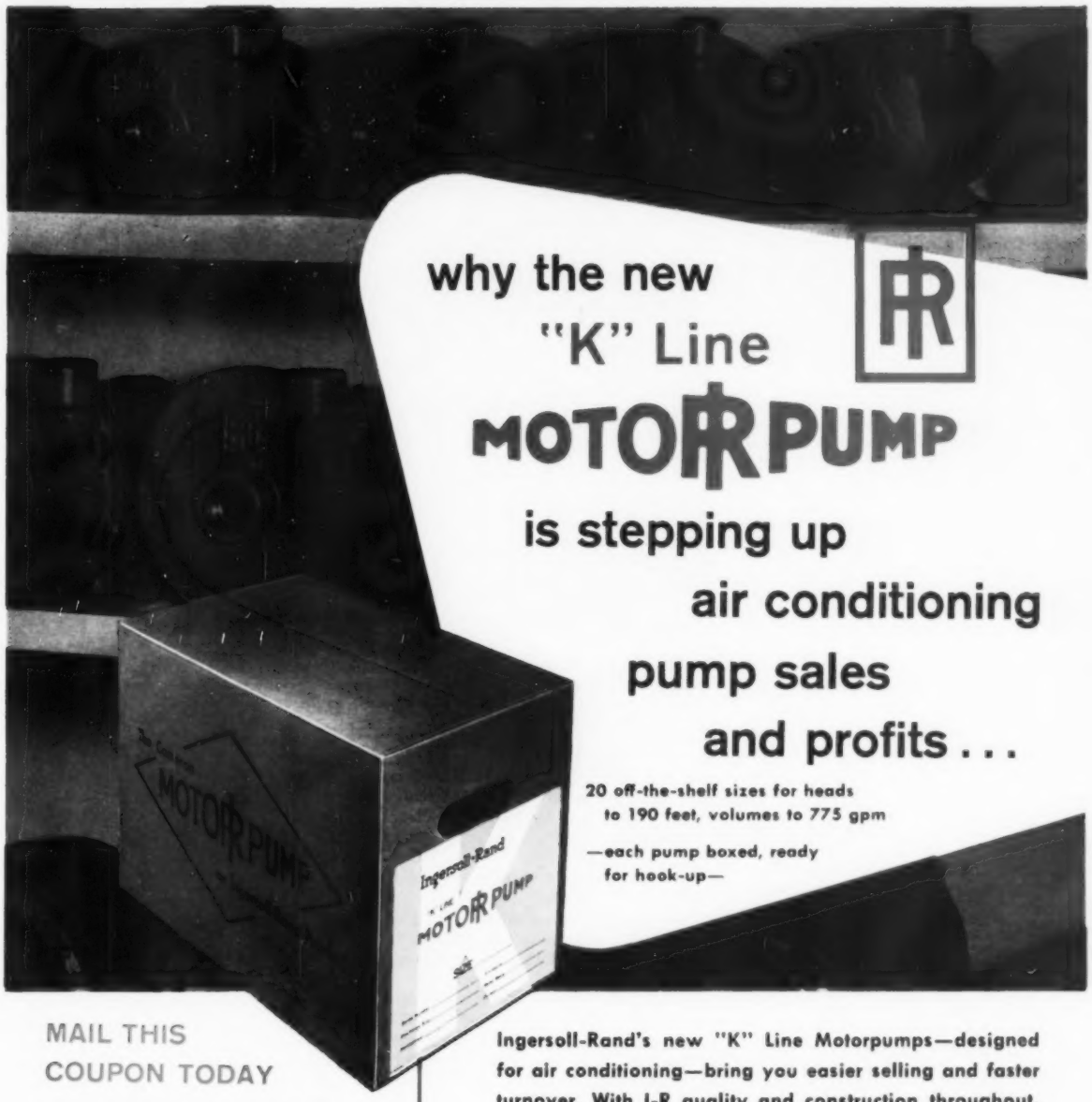
LOWER COSTS! New Spencer Package "C" Unit is quickly and easily installed . . . no high installation charges. And the elimination of a refractory chamber means lower operating costs . . . *lower maintenance costs!*

LOWER WATERLINE! A full 20% reduction in waterline height. Spencer's Unit is a real space-saver . . . and simple to clean, too! Boiler fire tubes are easily reached through the front flue door.

NEW, PROVEN METHOD! Spencer's revolutionary firing method has been rigorously tested, in accordance with SBI Table 2 Code . . . tested and FULLY APPROVED! Build up your boiler business . . . with the sensational new Spencer Package "C" Unit!

SPENCER HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

For complete details on any of Spencer's complete line of boilers, write to: Spencer Sales, Avco Corporation, Williamsport, Pa.



why the new "K" Line MOTOR PUMP is stepping up air conditioning pump sales and profits . . .

20 off-the-shelf sizes for heads to 190 feet, volumes to 775 gpm

—each pump boxed, ready for hook-up—

MAIL THIS COUPON TODAY

See how the new "K" Line Motorpumps can give you easier sales, higher profits.

Ingersoll-Rand Co., Merchandising Division
11 Broadway, New York 4, N. Y.

Gentlemen:

Please see that I receive full details on the profitable new "K" Line Motorpump.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Ingersoll-Rand's new "K" Line Motorpumps—designed for air conditioning—bring you easier selling and faster turnover. With I-R quality and construction throughout, new "K" Line Motorpumps offer these definite advantages:

- New Marketing Policy—Important advantages to help you meet the growing need for quality pumps at volume prices for volume sales.
- Minimum Inventory—20 "K" Line Motorpump sizes give complete hydraulic coverage, meet *every* requirement for volumes to 775 gpm, heads to 190 feet.
- Simplified Selling—I-R "K" Line Selection Charts tell you instantly the *right* pump size for any requirement.
- Customer Acceptance—Universally known Ingersoll-Rand quality means instant recognition and acceptance.
- Immediate Availability—"K" Line Motorpumps are available now for shipment. Each pump is boxed, ready for hook-up.

Ingersoll-Rand

9-891A **Merchandising Division, 11 Broadway, New York 4, N. Y.**

Facts to help you evaluate various airturning devices

Design . . . cost . . . installation . . . performance

Recent studies in the field and in Barber-Colman air distribution laboratories have shed some highly revealing light on the subject of guiding air around corners in duct systems. The facts uncovered should prove very useful to contractors and engineers concerned with both costs and system performance.

The studies involved long-radius elbows without vanes, square elbows with contractor-fabricated turning vanes, and square elbows with Barber-Colman Airturns.

Airturns vs. Long-Radius Elbows

Where space permits their use, long-radius elbows give good performance. With a minimum radius of one and a half times the duct width, pressure loss can be held within about 20% of velocity head.

However, square ducts with Barber-Colman Airturns give identically good performance — and cost less to install.

Performance has been exhaustively established in the laboratory through the use of visual air flow devices, piezometer rings, pitot tubes, and other instruments used by the slide rule boys (who have turned rule-of-thumb air distribution practice into an exact science). No other factory-made units currently available match Airturn performance.

The lower installation cost of square elbows with Airturns has been proved in the field by a number of large contractors who maintain detailed and accurate cost records.

Airturns vs. Contractor-Fabricated Vanes

Recently a contractors' association asked Barber-Colman to compare the performance of Airturns with that of both single- and double-thickness vanes fabricated in contractors' shops. Pressure loss with the Airturns ranged from 14% to 20% of velocity head. Loss with the various contractor-fabricated vanes ranged from 24% to 48% — from nearly two to more than four times as much! Engineering Bulletin EB-46 describing these tests is available to anyone upon request.

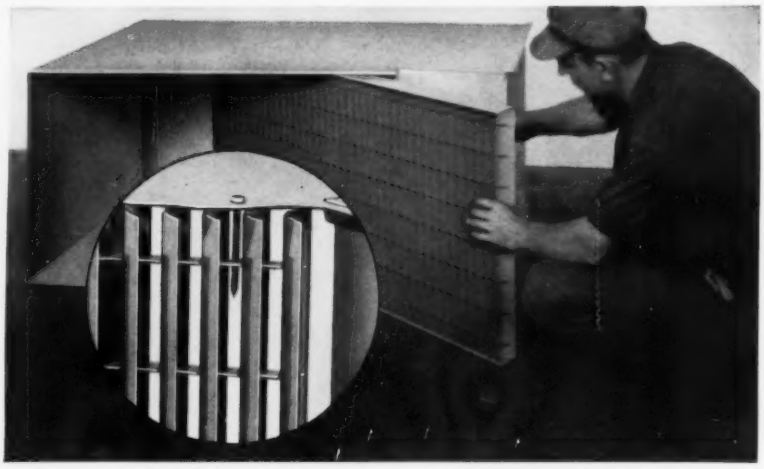


Fig. 1 — Barber-Colman Airturns are available in specific sizes . . . or in 48" x 48" slabs which many contractors find it convenient to stock. Exclusive compound radius vanes assure minimum pressure loss. Installation is inexpensive, quick, and easy — Airturns are held in place with sheet metal screws.

While a pressure loss in excess of 20% of velocity head may not always be serious in a single turn, the cumulative effect throughout a system adds up to a real headache and can result in call-backs that chew up profits in a hurry.

With contractor-fabricated vanes pressure losses are an unknown. Conversely, Barber-Colman Airturn pressure loss data gives you the true elbow losses throughout the system.

Cost of Airturns

Airturns are available cut to the sizes required, ready to install . . . or are available in 48" x 48" slabs. The slabs can be cut easily to required size with aviation snips or metalcutting power saws. In either case, the complete unit is quickly and easily installed with sheet metal screws.

Many contractors find it convenient to stock Airturns with 48" bars and with vane lengths to correspond to the height of ducts commonly used.

When initial cost, installation cost, and call-back costs are considered, it is not hard to see that Barber-Colman Airturns are a good buy. Even if system performance and ease of installation were disregarded, the high cost of shop labor appears to give Airturns a comfortable cost advantage over contractor-fabricated vanes.

Literature

If you would like to know more about Airturns or would like to place an order, call your local Barber-Colman air distribution field office or write.

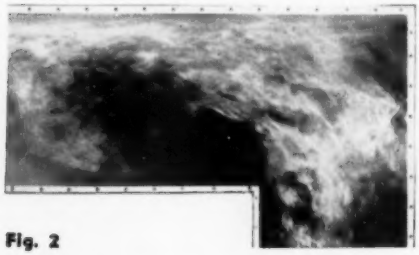


Fig. 2

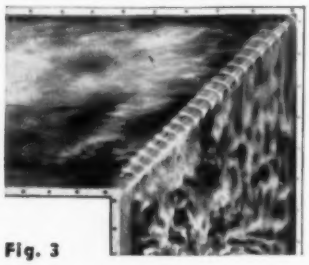


Fig. 3

Air flow studies in Barber-Colman laboratories show that a square duct corner without turning vanes creates pressure losses in the area of 167% of velocity head (Fig. 2).

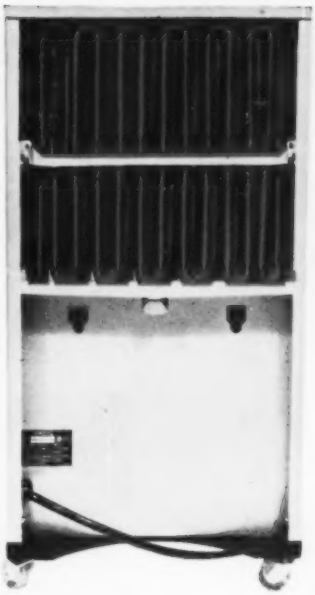
With a Barber-Colman Airturn, pressure loss is but 20% of velocity head — performance otherwise attainable only by use of a space-consuming long-radius elbow (Fig. 3).

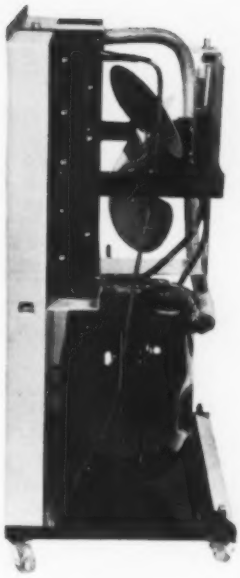
BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. S, 1101 Rock Street, Rockford, Illinois

Ebco whips the moisture monster





WOLVERINE TUBE *is the Brawn of Oasis Portable Dehumidifiers*

Wringing every bit of damaging moisture from the air is a job that Oasis portable dehumidifiers, manufactured and marketed by Ebco Manufacturing Company, do well.

Ebco uses miles and miles of Wolverine commercial copper tube for the muscle jobs in the inner workings of the Oasis units.

This Wolverine copper tubing ranges from tiny Wolverine Capilator®—the capillary tube for precision metering of liquids and gases—to larger diameter coiled and straight length tubing which is fabricated by Ebco into the serpentine coil that extracts moisture from air as it is drawn over the refrigerated tube surface. The Ebco Manufacturing Company is another in the long line of nationally-known firms that find in Wolverine tubing exactly the type of product they need to meet their own high standards of quality.

If your company uses copper, copper alloy or aluminum tubing, why not follow the lead of top line companies such as Ebco and specify Wolverine next time you order.

For complete information write for your copy of "Wolverine Serves the Refrigeration Industry."

CALUMET & HECLA, INC.
CALUMET DIVISION
URANIUM DIVISION
GOODMAN LUMBER DIVISION
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17256 Southfield Road
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Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES
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Six steps to better curbing with Penn Ventilator

SELF-FLASHING EXTRUDED ALUMINUM SONOTROL CURB

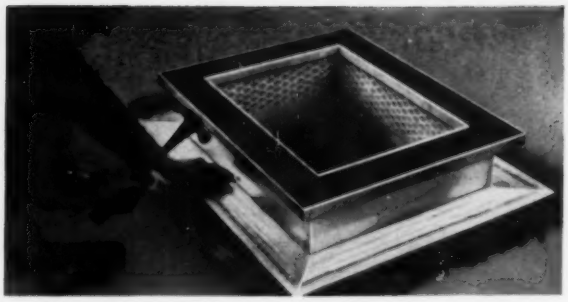
That's all there is to it. It's the biggest advance yet in roofing curbs. Eliminates errors in the field . . . no more coordinating, flashing and waiting. You just place your order when roof opening dimensions are set . . . and the curb is delivered when you need it. Penn Ventilator is the single source of responsibility. You get ventilator, curb and damper . . . and everything fits.

The self-flashing feature keeps units low to the roof and is used and approved by leading roofing material manufacturers. All-aluminum construction of the new Sonotrol Curb reduces roof loading, saves time, makes it easy to handle. "I" beam design adds to its sturdiness. It's nonporous and weathertight, includes an integral neoprene-rubber gasket. Special acoustical insulated lining provides for sound attenuation, and eliminates condensation.

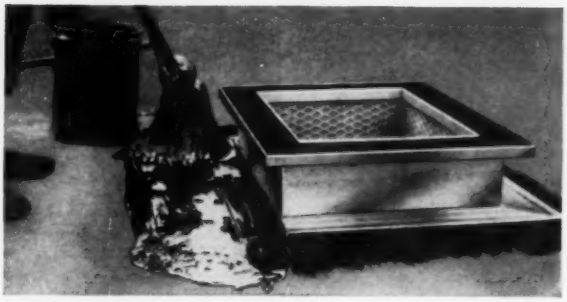
Get complete details on this revolutionary self-flashing Sonotrol Curb that actually costs no more than the "hit-or-miss" method of field construction. Your nearby Penn Ventilator man has a sample section to show you.

1. Butter 12" wide bed of plastic roofing cement around roof opening.

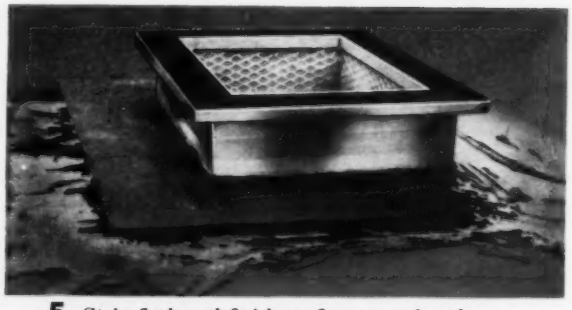
2. Set curb in roofing cement.



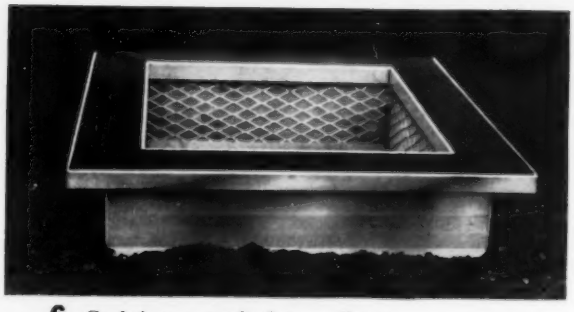
3. Fasten curb to roof deck.



4. Prime for strip flashing.



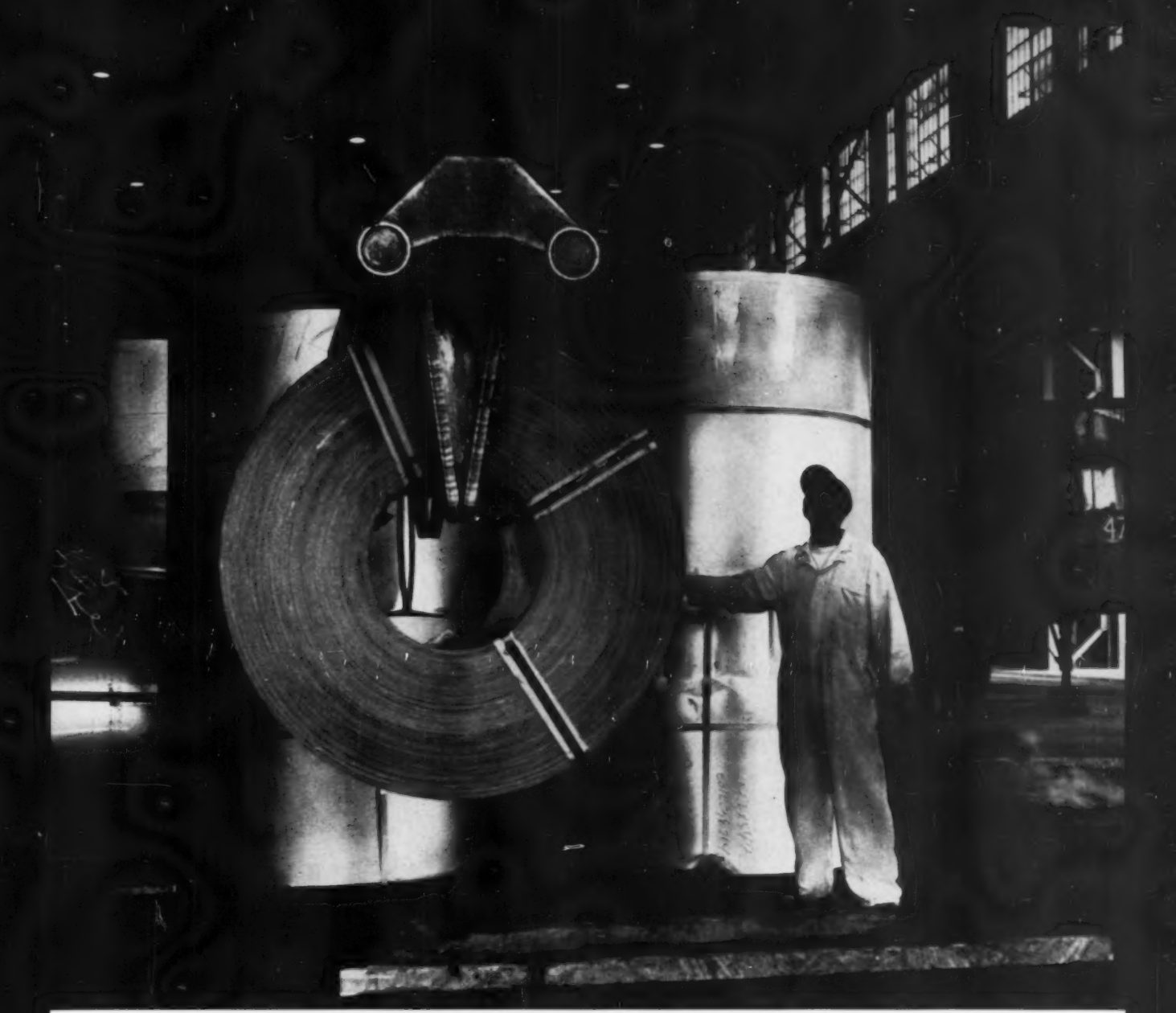
5. Strip flash and finish roofing around curb.



6. Curb is now ready for ventilator.

PENN VENTILATOR CO., INC.
GOODMAN & ALLEGHENY, Philadelphia 40, Pa.
Representatives and Distributors in Principal Cities
Charter member of AMCA

A Leading Manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 25 years.



INSTANT STEEL

A CALL TO YOUR LOCAL STEEL DISTRIBUTOR ENDS IN-PLANT SHORTAGES FAST!

Emergency? Your steel service center can end it in a hurry with practically any amount, quality, size or shape of steel you may need. No more in-plant steel shortages—no more plant shutdowns—no more lost contracts.

Or you may choose to use his facilities, stocks and fast delivery service on a regular basis. Whatever your production needs, your local steel distributor is on hand ready to give instant service. All you have to do is phone.

Call him for any quantity of Weirkote continuous-process zinc-coated sheets, Weirzin electrolytic zinc-coated sheets, hot- or cold-rolled sheets or any type of steel you may need for any type of production job.

WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

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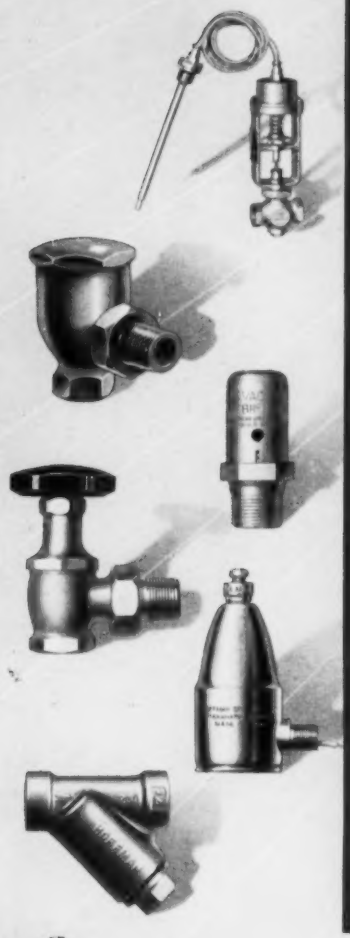
NATIONAL STEEL CORPORATION

HOFFMAN *Complete line of* STEAM SPECIALTIES

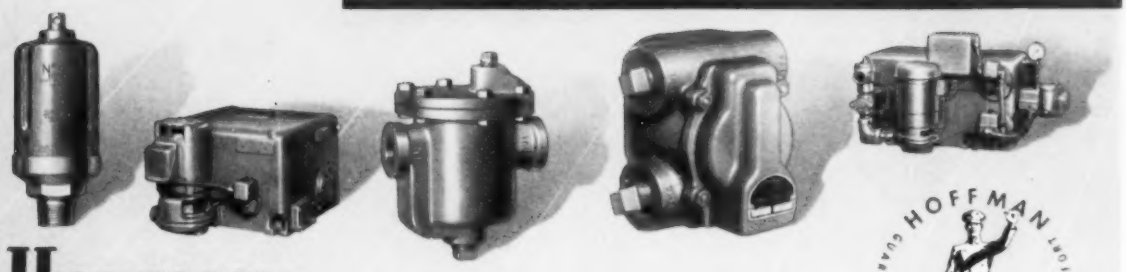
Half a century of specialized engineering and production experience provides a complete *quality line* of precision products for industrial, institutional, and residential Steam Heating Systems. For example, here are just two from Hoffman's line of Pressure Reducing Valves. They will reduce the pressure of fluids from a higher initial pressure to a lower secondary pressure.



No. 710 PRESSURE REDUCING VALVE
For steam, water, air, oil, or gas. Single seated valve for either dead-end or continuous service. Max. high pressure: 250 lbs. per sq. in. Low pressure range: 5 to 80 lbs. per sq. in. Sizes ½" through 1½".

No. 700 PRESSURE REDUCING VALVE
For steam heating systems. Double seated design limited to continuous service applications. Max. high pressure: 200 lbs. per sq. in. Low pressure range: 1 to 15 lbs. per sq. in. Sizes ½" through 8".

Whether your need is for improved design Pressure Reducing Valves, Traps or Pumps, simply call your local Hoffman wholesaler, or write for free literature.



HOFFMAN SPECIALTY MFG. CORP. 1700 West 10th Street Indianapolis 7, Indiana

VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS, STOCKED AND SOLD BY LEADING WHOLESALERS OF HEATING AND PLUMBING EQUIPMENT.

Another new development using

B.F.Goodrich Chemical *raw materials*

Now gas comes home through pipe of Geon

The pipe in this natural gas distribution system is made of Geon rigid vinyl. Years from now it will be feeding gas to homes just as efficiently as the day after installation. This pipe stays smooth inside and out because it is not affected by the corrosive influences that affect ordinary pipe. No problems from salt water, chemicals, acid or alkaline soils, or galvanic corrosion.

Conduit or pipe made of Geon provides high tensile and impact strength. It stands up under pressure, resisting effects of fungi, bacteria, moisture, heat or cold. It makes a big hit with installation crews, since it is so light weight and so easy to install.

Engineers are taking advantage of the properties of versatile Geon polyvinyl material for this and many other types of applications. For information, write Dept. AX-3, B. F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

1¼" diameter pipe of Geon rigid vinyl is being installed by Illinois Power Company in gas lines leading to homes at Decatur, Illinois. In addition, ¾" vinyl pipe is being inserted in reamed-out 1¼" iron pipe under streets to avoid breaking the pavement to repair leaking gas lines. Kraloy Plastic Pipe Company, Los Angeles, California, makes the pipe. B.F.Goodrich Chemical Company supplies the Geon rigid vinyl.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

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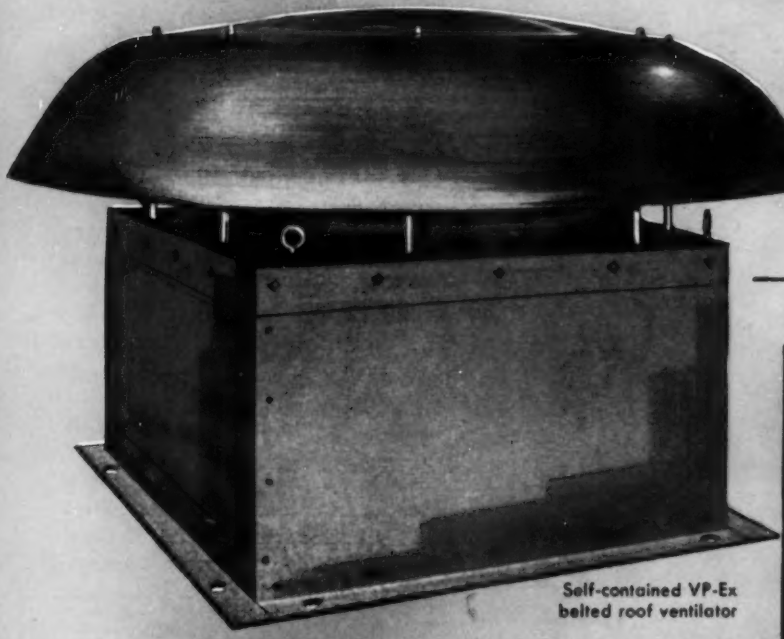
GEON polyvinyl materials • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

VP-EX PROPELLER-TYPE

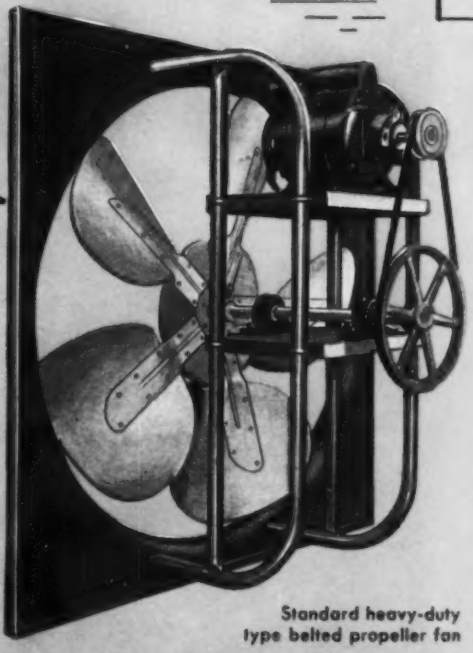
belted roof ventilator



Self-contained VP-Ex belted roof ventilator

The outstanding performance of the VP-Ex Belted Roof Ventilator is derived from insistence on quality at every step—from its galvanized construction through its complete industrial-type propeller fan. This large-capacity workhorse keeps overall height at a minimum while providing efficient operation and proper clearance between air discharge and roof. Capacities from 4450 CFM to 33900 CFM; also available in smaller direct drive sizes.

Send for Bulletin 582.

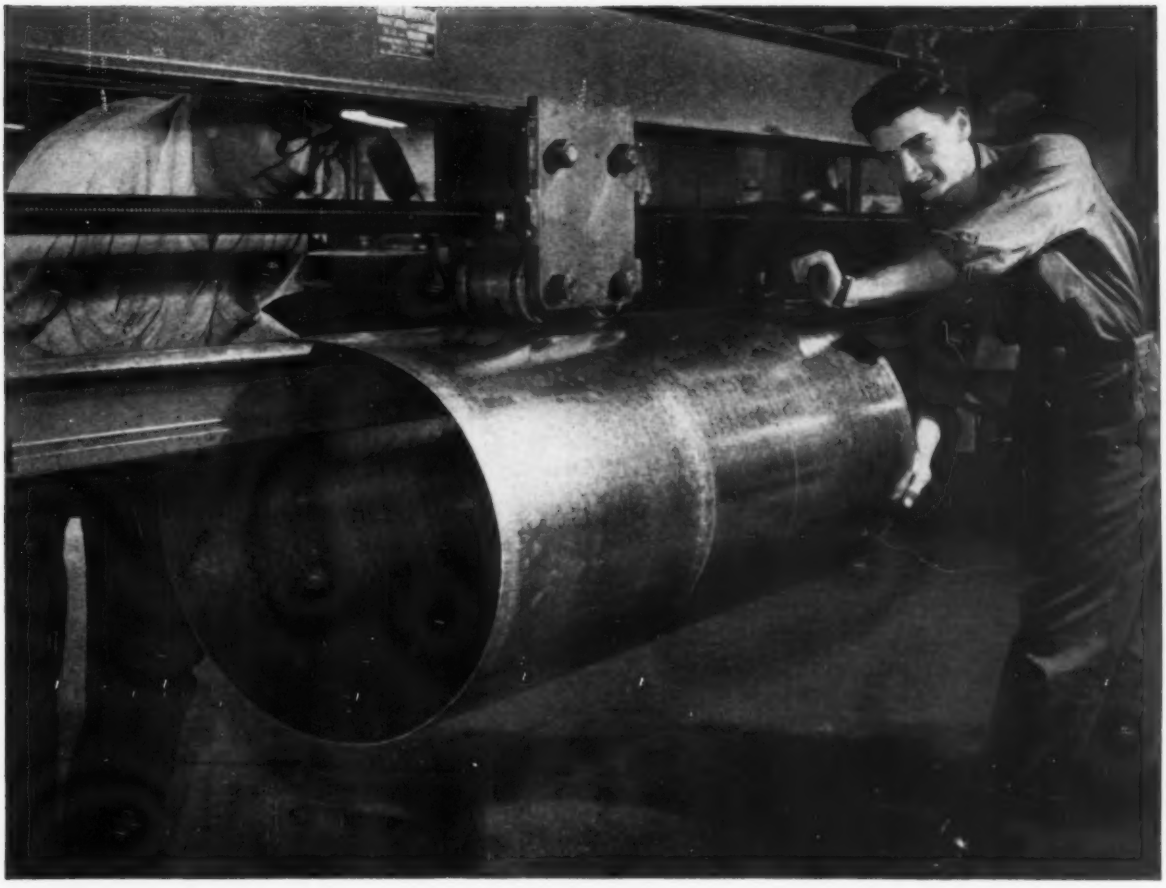


Standard heavy-duty type belted propeller fan

nyb

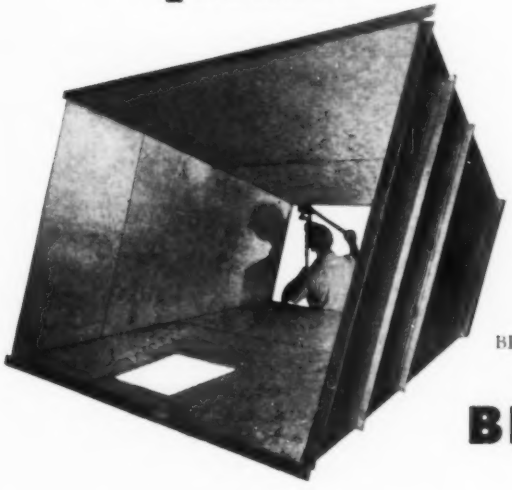
THE NEW YORK BLOWER COMPANY

SALES OFFICES: 3149 SOUTH SHIELDS AVENUE • CHICAGO 16



Bethcon Galvanized Steel

forms easily, builds strong product



When you flex a piece of Bethcon galvanized sheet steel, you notice it has a certain extra "something." Liveliness, if you will. Toughness, perhaps. Or strength with ductility. Whatever you might call it, Bethcon is a sheet that forms up easily, builds a strong end product.

There's a sound metallurgical reason for Bethcon's unique qualities. Our continuous galvanizing lines include a special annealing cycle which gives the steel its very desirable combination of ductility and stiffness. In addition, the galvanizing process deposits the zinc on the sheet so tightly that even the toughest forming and bending will not crack the coating.

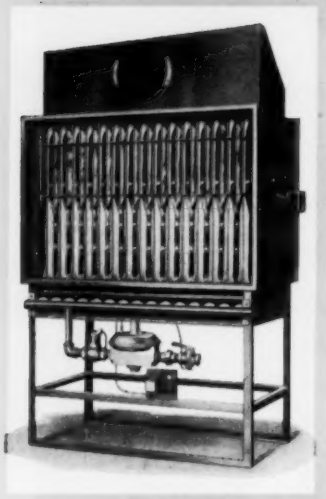
You can specify Bethcon in a wide variety of gages and widths, coiled or in cut lengths. The base metal can be either plain open hearth steel or copper-bearing (Beth-Cu-Loy). A Bethlehem representative will be glad to supply further information.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

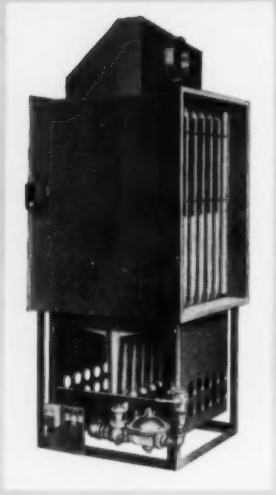
BETHLEHEM STEEL

BETHLEHEM STEEL

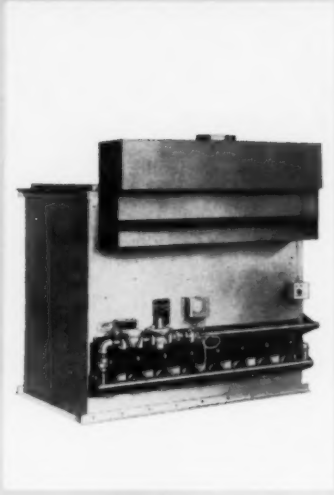
HAYES STAINLESS STEEL HEAT EXCHANGERS



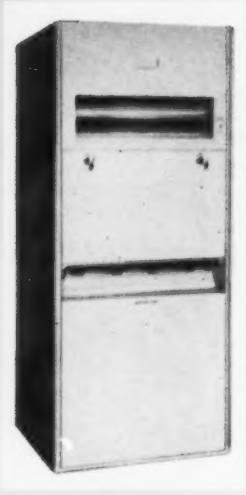
SED-E



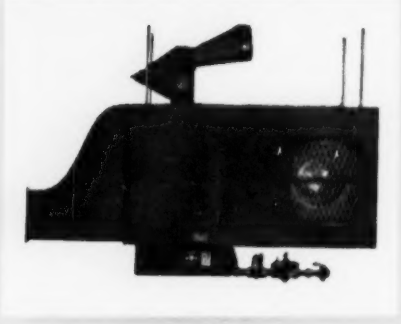
SED-S



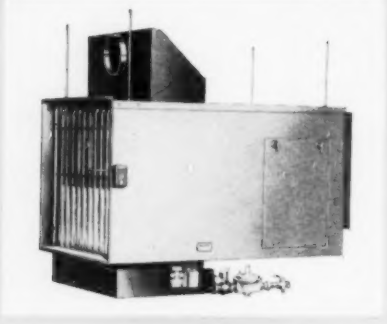
SED-VF



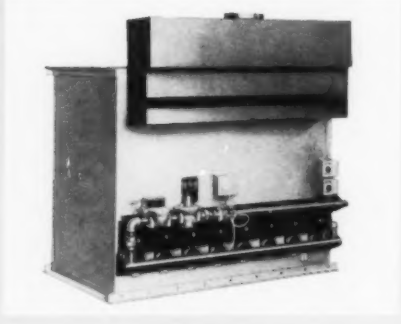
SEC



SEU



SES



SED-CF

SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation down-stream of cooling equipment, for continuous blower operation. Air through-put in either direction. 45,000 to 675,000 Btu input.

SED-S — Same as SED-E except controls are at the side. Either SED-E or SED-S is available in sizes from 45,000 to 675,000 Btu input in increments of 45,000 Btu.

SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. 7 sizes from 70,000 to 280,000 Btu input.

SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower. 7 sizes — 70,000 to 245,000 Btu input. For zero clearance.

SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 480,000 Btu input.

SES — Forced air, suspended furnace for installation in suspended duct system. Designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

SED-CF — Tested and approved as a duct furnace for counterflow. Recirculating fresh air thru the top. Has a built-in bypass. Sizes from 70,000 to 280,000 Btu input.

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The pitch is on the way; from here on in, the batter's timing really counts! And when it's *your* turn at bat to solve a motor-drive problem for appliances or equipment, Emerson-Electric will work with you to make your timing *perfect!*

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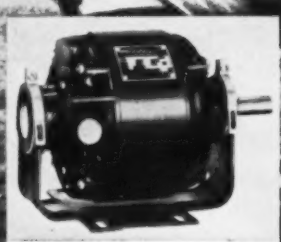

To get the kind of timing that pays off in the profit column, call, wire or write Dept. M382 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

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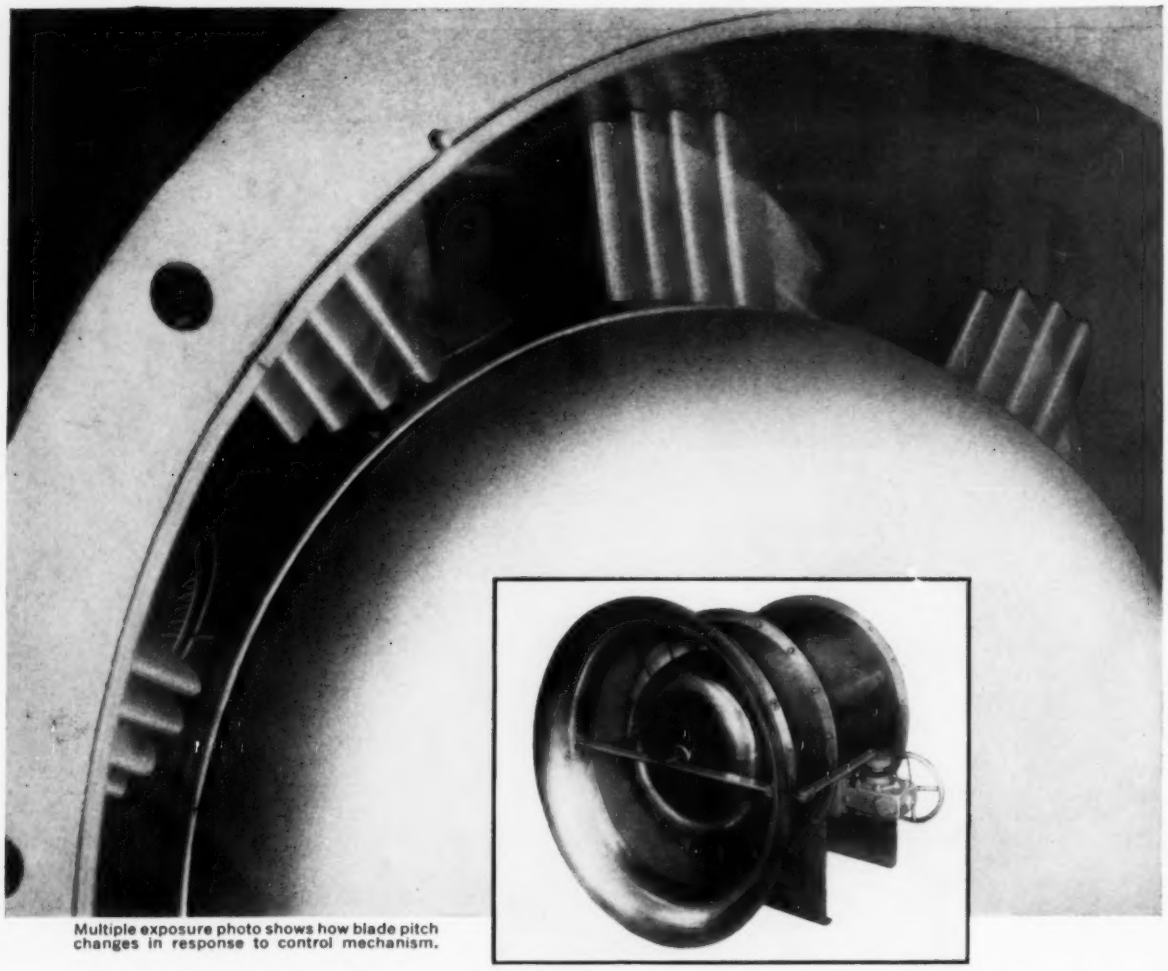


Multiple exposure photo shows how blade pitch changes in response to control mechanism.

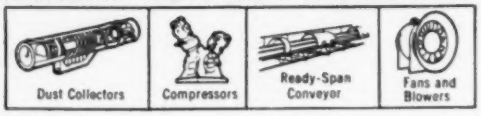
Automatic Adjustment of Air Supply to CO_2 Concentration, Temperature or Humidity with Joy Controllable Pitch Axivane® Fans

The blade pitch on Joy Axivane Fans can be changed automatically while the fan is running, varying the air volume as much as ±20%. The controlling mechanism can be linked to a sensing device to make air volume respond to a change in ambient temperature, humidity, concentration of a gas, or any of a number of conditions.

Controllable Pitch Joy Axivane Fans are ideal for ventilation of vehicular tunnels and work areas in which noxious gases tend to collect, maintaining air cooled equipment at an even temperature, stabilizing moisture content in an area, or any application requiring a variable supply of ventilation air.

Write for complete details on how Joy Controllable Pitch Axivane Fans can be made to suit your particular situation. Ask for bulletin 289-41.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY



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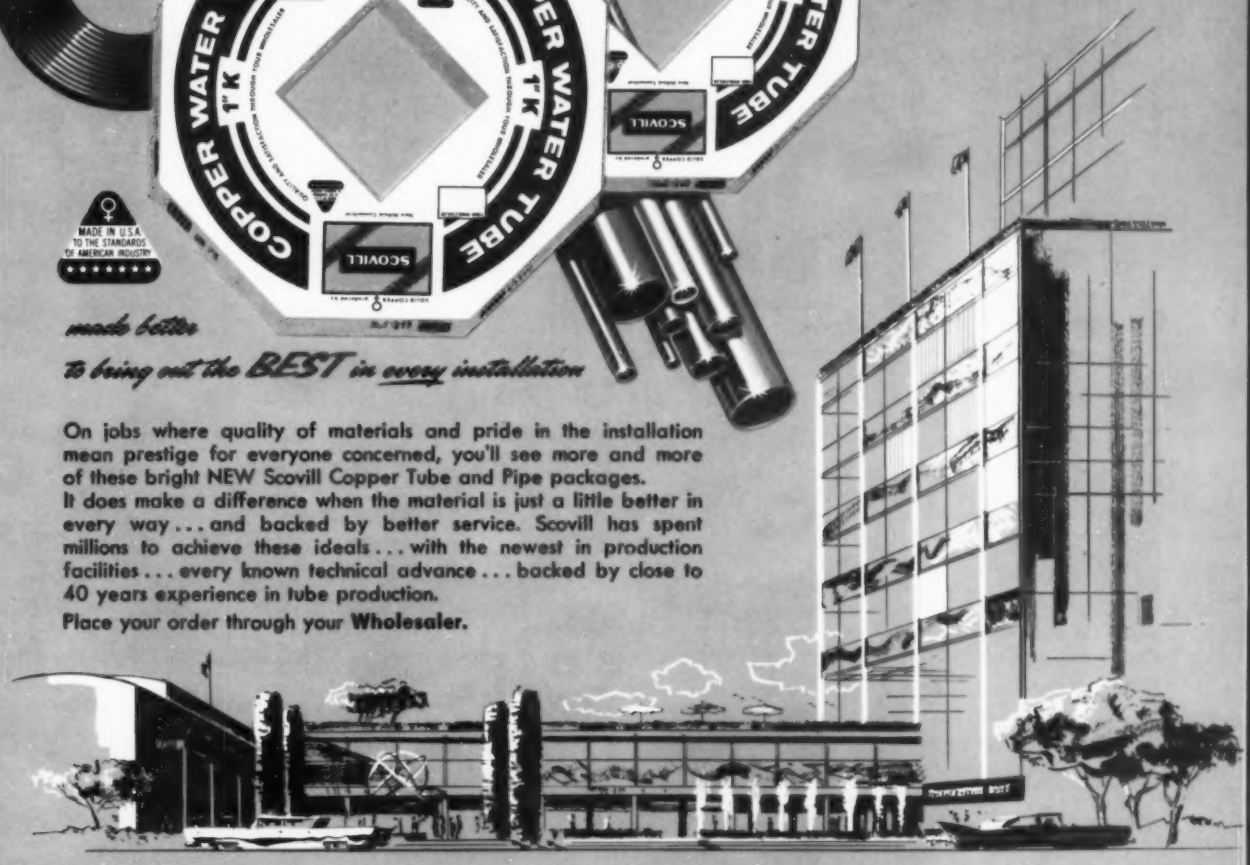

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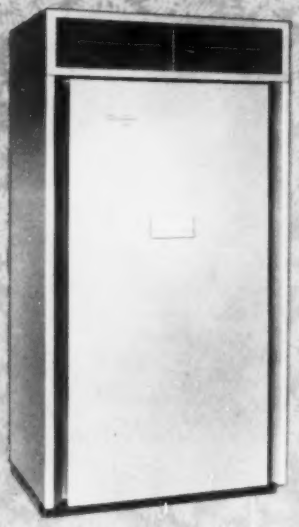
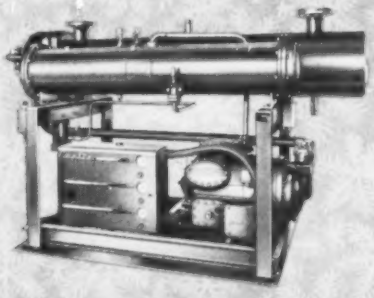
Curtis

CONDITIONS COMMERCIAL AMERICA...



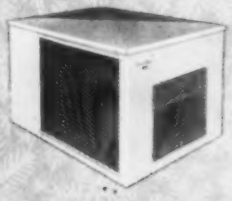
Curtis packaged units minimize floor area required. Factory assembled and tested. Field installation requires only setting and connecting utilities.

PACKAGED AIR CONDITIONERS UP TO 100 TONS.



PACKAGED LIQUID CHILLERS UP TO 100 TONS.

AIR-COOLED UNITS UP TO 10 TONS.



PRECISION

close tolerance manufacturing, builds peak performance into every CURTIS unit.

Curtis is the "luxury line" in the air-conditioning industry. Silence, efficiency and long-life are inherent in Curtis design.

Yet Curtis prices are right in line.

This is why Curtis designs and builds thousands of unique air conditioning systems for commercial America . . . why Curtis is able to maintain a family of over 300 representatives and servicing contractors across the nation.

Put the advantages of CURTIS PRECISION into your next job.

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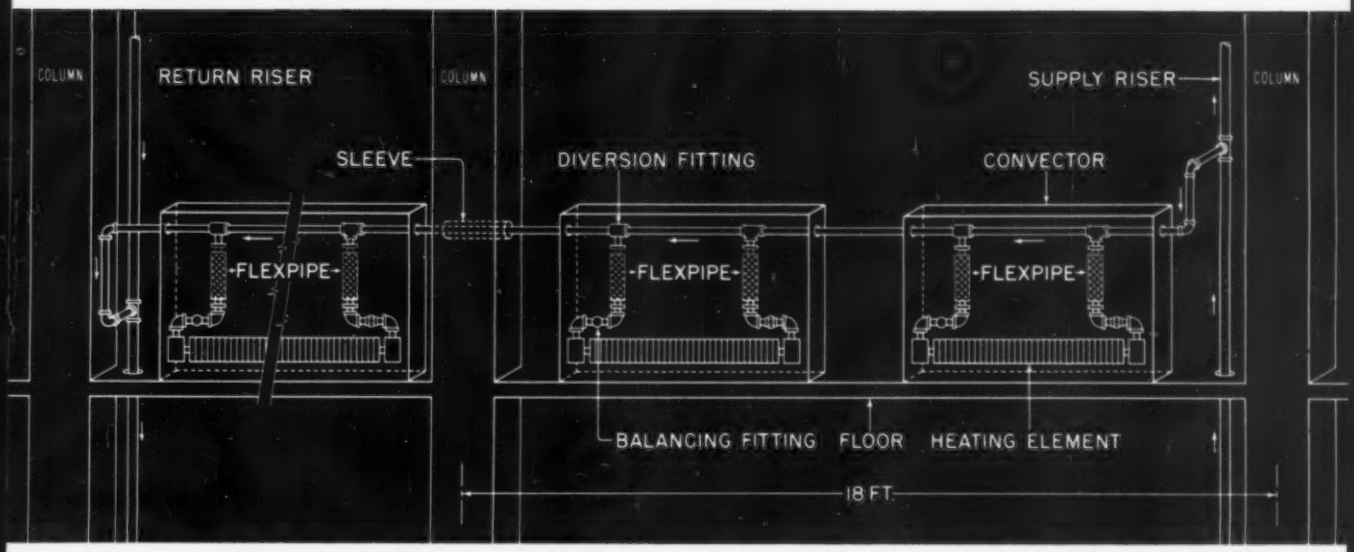
THE CURTIS "LUXURY LINE" OF AIR CONDITIONERS COSTS NO MORE

APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe

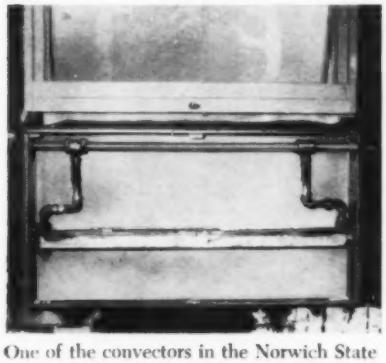


Heating system in Intensive Treatment Building, Norwich State Hospital. Architect: Lester Julianelle, New Haven, Conn. Consulting Mechanical Engineer: Hubbard, Lawless & Blakeley, New Haven, Conn. Plumbing & Heating Contractor: George Kaucher Co., Wolcott, Conn.

Flexpipe connectors at convectors provide big savings in pipe and fittings for hospital heating system

THE PROBLEM: To reduce the cost of installing the heating system in the 300-bed Intensive Treatment Building of the Norwich, Conn., State Hospital. The hospital was constructed under an appropriation of $5,000,000.

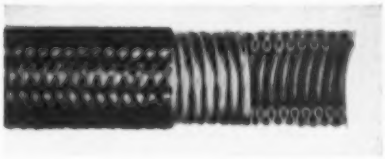
THE SOLUTION: Consulting mechanical engineers, Hubbard, Lawless & Blakeley of New Haven, devised a system using single horizontal mains passing through a number of convector cabinets in series. The runs go up to 70 feet, connecting as many as eight convectors. Each bay of approximately 18 feet has two convectors and the columns are sleeved to accommodate the mains. This arrangement, of course, greatly reduced the number of risers and fittings.



One of the convectors in the Norwich State Hospital, showing how Flexpipe connectors are used to join the main and the heating element.

In the long runs, however, expansion is a big problem. So rigid connections at the convectors were out of question. Flexpipe connectors were used at the convectors as shown in the drawing above. The mains can expand and contract, with no strain on the heating elements. The savings planned were accomplished because both the quantity of pipe and the number of fittings are at an irreducible minimum.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors throughout the country. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 59154



Flexpipe has core of flexible seamless tin bronze tubing. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing. Flexpipe connectors also available in larger sizes for pump and compressor connections. Write for Bulletin FP-4.

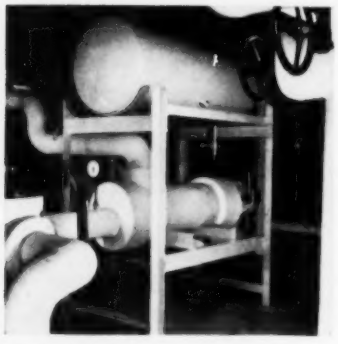
Flexpipe®

an

ANACONDA®

product

Each children's unit contains bedrooms, bath, infirmary, Sister's room, sewing room, recreation room, dining area and classroom.



B&G Steam Converters provide hot water for radiant heating system in children's units.

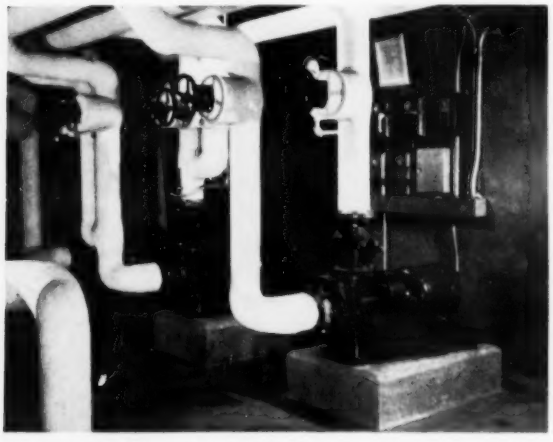
The Nazareth Children's Boarding School, Boston, Mass., consists of ten children's units or cottages, each containing complete living and classroom facilities. In addition, there is a physical education wing, service area, an administration and convent section and a chapel. The engineering design includes various types of heating to meet the differing requirements.

The children's units are the core of the institution and are heated by radiant floor panels served by a forced hot water system. This system is a B&G primary-secondary pumping installation which operates as follows:

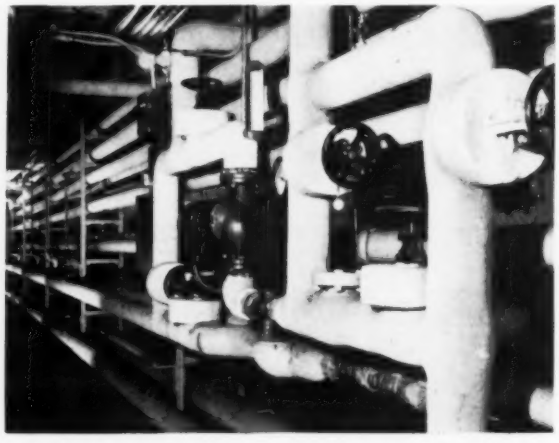
Hot water for the system is furnished by B&G Converters connected to the steam boilers. Two B&G Universal Pumps, each serving one-half the units, are used to circulate two main circuits. Each of the ten units is on a separate secondary circuit equipped with a B&G Booster Pump. *This arrangement permits individual and accurate control of the zone circuits!*

Every zone has a three-way valve upstream of the circulating pump. The valve passes a mixture of zone return water and hot water from the mains which is pumped to the zone coils.

It is important to the success of this arrangement that there be a reasonably constant pressure difference between supply and return in the mains at each zone piping take-off. A bypass valve is, therefore, provided at each point, positioned by a local differential pressure controller.



Two B&G Universal Pumps circulate the primary mains. One Universal is installed as a standby.



B&G Booster Pumps under individual control circulate the secondary circuits in the children's units.

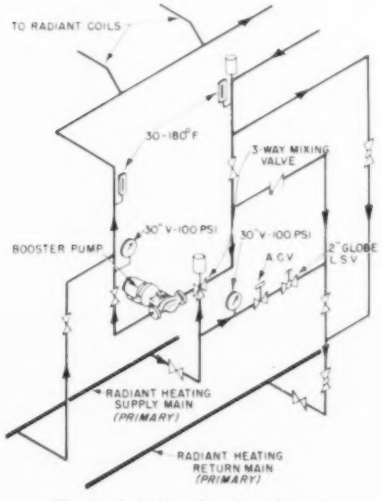
Chapel and Convent

Children's Boarding School shows advantages of B&G PRIMARY AND SECONDARY PUMPING in hot water heating systems

Steam is admitted to the central converters under control of an immersion thermostat which is reset by an outdoor compensator to produce water temperatures in the supply mains ranging from approximately 125°F at 0° outdoors to 80°F at 65° outdoors. For each zone the controls include an outdoor thermostat, two averaging indoor thermostats and a manual "Warmer-Cooler" control in the corridor. All these instruments operate to position the zone mixing valve and are remote except for the "Warmer-Cooler" switch.

A pneumatic-electric switch stops each zone pump when the associated three-way mixing valve assumes a full bypass position. The main B&G Universal Pumps start automatically when outdoor temperature drops to 60°F and run continuously until outdoor temperature rises to 65°F.

B&G UNIVERSAL PUMP



Typical piping plan for primary and secondary pumping system.

Architects:
Maginnis & Walsh & Kennedy, Boston

Heating Engineers:
Slocum and Fuller, Boston

General Contractors:
Thomas O'Connor & Co., Inc., Boston

Heating Contractor:
J. C. Higgins Company, Boston

B&G BOOSTER PUMP

Reg. U.S. Pat. Off.

BELL & GOSSETT
COMPANY
Dept. FU-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

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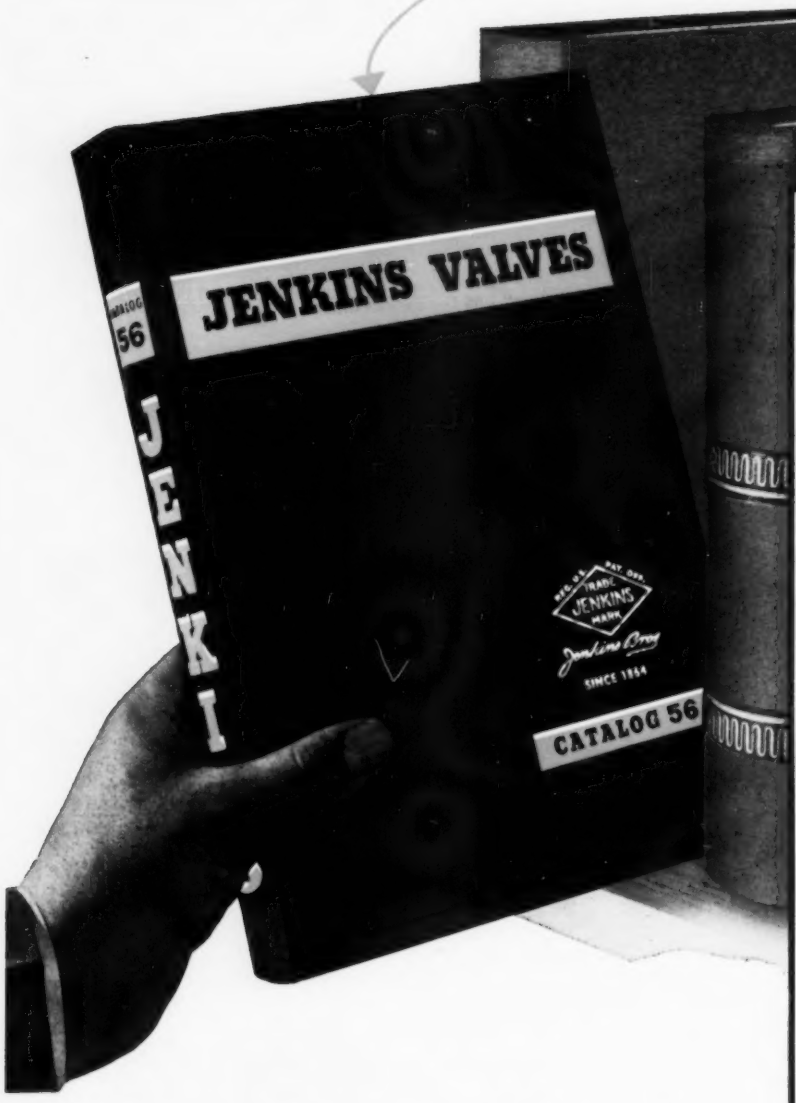

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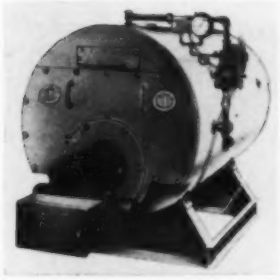
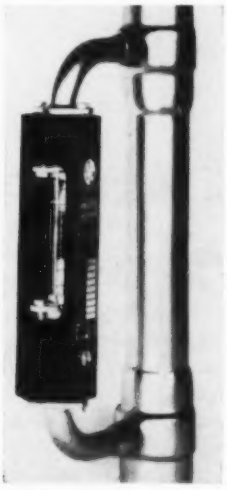
For reviews of Recent Trade Literature see page 230



Boiler-Burner Units . . .

. . . designed to meet requirements of wide range of applications where low pressure heating and/or process steam is required—*Pacific Steel Boiler Div., National-U. S. Radiator Corp., Dept. HPAC, 944 Ash St., Johnstown, Pa.*

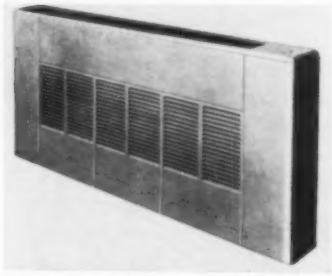
Packaged steam and hot water scotch type boiler-burner units available in 20, 30, 40, 50, 60 hp models for oil, gas or combination oil-gas firing. "Wet back" design of units said to eliminate need for rear refractory or suspended arch.



Flow Indicator . . .

. . . designed for indicating flow of water in gpm through hot water heating or air conditioning installation—*Bell & Gossett Co., Dept. HPAC, 8200 N. Austin, Morton Grove, Ill.*

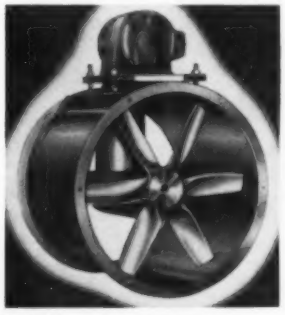
"Thermoflo Indicator" has following features as cited by manufacturer: quiet operation; low pressure drop; never more than two "Monoflo" fittings; easy-to-read scale. Six sizes of unit range from 1 to 3 in. Capacities from 1 to 10 gpm up to 60 to 300 gpm.



Inductor Air Conditioners

. . . developed for application to perimeter areas of multi-room buildings using conventional ductwork—*American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

Inductor units designed to provide heating, humidification, cooling dehumidification for perimeter areas of office buildings, laboratories, various multi-room structures requiring relatively large volumes of air for ventilation. Available in five unit sizes: 20, 28, 36, 48 and 60—numbers designating tube length of secondary coil in inches. Capacities from 40 to 700 cfm supplied by units.



Belt Drive Duct Fans . . .

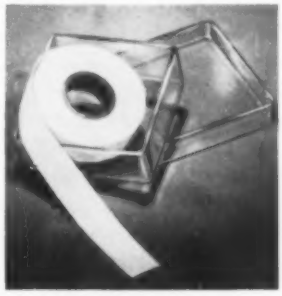
. . . with variable pitch drives designed to permit easy adjustment of fan speed—*Hartzell Propeller Fan Co., Dept. HPAC, P. O. Box 909, Roosevelt Ave., Piqua, Ohio.*

Adjustment of driver sheave will slow fan down to reduce air deliveries by up to 1/3 where maximum performance is not required. Components have been completely standardized within each fan size.

Aluminum Pipe . . .

. . . now available in range of Schedule 40 equivalent sizes—*Reynolds Metals Co., Dept. HPAC, Box 2346, Richmond 13, Va.*

"Reynolds Heavy-End Pipe" tapered in thickness to provide extra strength at joints while eliminating excess metal in pipe body. Available in 30, 40 ft lengths, pipe can be used interchangeably with other standard aluminum pipe. Equivalent sizes for both Schedule 80 and 40 now available.



Pipe Joint Sealer . . .

. . . in plastic tape form—*Crane Packing Co., Dept. HPAC, 6400 Oakton St., Morton Grove, Ill.*

Pipe joint sealer developed to safely handle most industrial acids, corrosives, caustics, hydraulic fluids, aromatic fuels; also recommended for alkalis, toxics, biological and gas service. Temperature range −250 to 500 F. "Thred-Tape" can be used on plastic, aluminum, stainless steel, ceramic, synthetic rubber and carbon pipe. Available from manufacturer in ½ × 288 in. rolls.

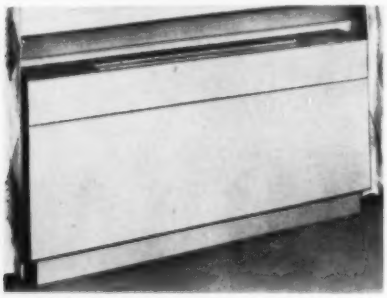
EQUIPMENT DEVELOPMENTS

Continued

Flame Detector Unit . . .

. . . developed to deal with flame sensing problems, including refractory over-ride and hold-in—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2747 Fourth Ave., S., Minneapolis 8.*

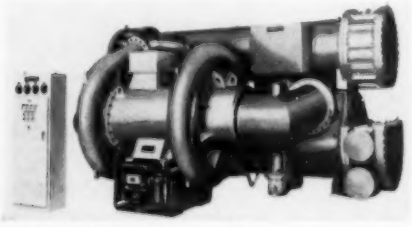
"C7012A" ultraviolet-sensitive tube acts as flame detector unit for flame from any type of fuel. Intended for use with variety of burners, including heavy and light oil, gas and combination gas-oil burners.



Air Conditioning Units . . .

. . . designed to provide year 'round service—*Remington Air Conditioning Div., Remington Corp., Dept. HPAC, Auburn, N. Y.*

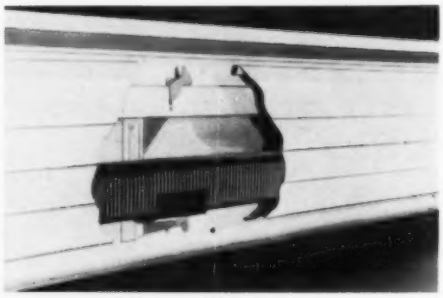
"Type EK" incremental air conditioning units offered in three cooling capacities from 9000 to 15,100 Btu per hr, and three heating capacities from 8000 to 15,300 Btu per hr. All capacities offered for either 208 or 230 volt single-phase current. Recommended by manufacturer for multi-room building applications.



Centrifugal Refrigeration . . .

. . . developed for applications requiring 400 to 800 ton operating capacity—*American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

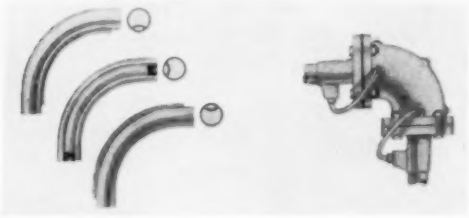
Designed to provide chilled water for air conditioning of large buildings and factories, two stage "Tonrac" refrigeration machines also adaptable to heat pump applications. "Series 235" operates on Refrigerant 11 with water-cooled hermetic motors available for operation with 208 to 6600 volt current. Impellers directly driven at 3600 rpm, supported on overhung extended motor shaft.



Baseboard Radiation . . .

. . . designed to provide economical, modern heating system—*Radiant-Ray Radiation, Inc., Dept. HPAC, Box 214, Newington, Conn.*

Baseboard installed without cutting, adjusting, and is supplied with damper vane as integral part of unit. Available in six lengths from 1½ to 8 in. Baseboard enclosure made of bonderized steel with baked enamel prime coat finish.



Steam Tracing . . .

. . . with new components and increased maximum size—*Aluminum Co. of America, Dept. HPAC, 1501 Alcoa Bldg., Pittsburgh 19.*

"Unitrace" integral steam tracing now available with outside diameter equal to 8 in. pipe to handle such bulk material as fuel oil, urea, asphalt. Fittings used to incorporate "Unitrace" into standard piping systems now includes new flange, adapter flange, 90 deg elbows.

Gas Water Heater Control . . .

. . . designed for use on larger size water heaters—*Grayson Controls Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 100 W. Victoria St., Long Beach 5, Calif.*

"Unitrol 400 R" gas water heater control can be used on units with burning rate as high as 100,000 Btu per hr. Features cited: slip top cover; flip-top lid; built-in pressure regulator; universal pilot gas filter.

How B&W JOB-MATCHED TUBING saves in oil heater applications

. . . A complete range of carbon, alloy and stainless steels—permits choice of steel to match service conditions.

. . . A wide size range—provides for freedom of design.

. . . Uniform dimensions and mechanical properties — helps to provide ease of fabrication.

These are just a few of the reasons it pays to specify B&W Job-Matched Seamless Pressure Tubing. Call the tubing specialist at your local B&W District Sales Office, or write for Bulletin TB-417 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

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TUBULAR PRODUCTS DIVISION

TA-9016-SP2

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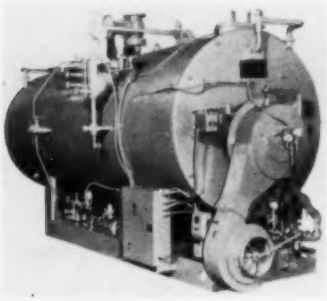
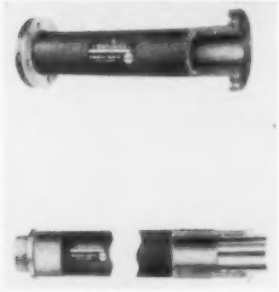
EQUIPMENT DEVELOPMENTS
Continued



Packaged Boilers . . .

. . . with new design features—*Ames Iron Works, Inc., Dept. HPAC, Oswego, N. Y.*

"Model AA" air atomizing "Amesteam" packaged steam generators have newly designed air atomizing oil burner and new ring type gas burner. Boilers are packaged, factory assembled, fire-tested. Available in complete range through 600 hp.



Piping Connectors . . .

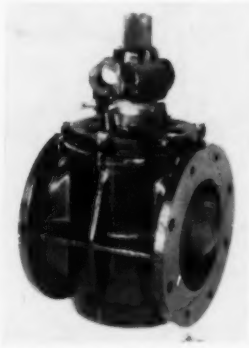
. . . designed for use in controlling water line noises, eliminating equipment vibration, coping with alignment problems, etc.—*Korfund Co., Inc., Dept. HPAC, 48-01 F 32nd Pl., Long Island City* 1, *N. Y.*

"Series R Flex-Hose" light weight, flexible rubber pipe sections attenuate up to 90 percent of vibration, noise, according to manufacturer. Constructed of several layers of multiple-ply rubber and fabric, and wire reinforcement. Developed to withstand temperatures to 250 F, handle pressures to 250 psi. "Type RF" available in nine pipe sizes from 2½ to 12 in.; lengths from 24 to 60 in; "Type RHM" brass fitted couplings available in eight pipe sizes from ¾ to 4 in., lengths from 12 to 36 in.

Air Filter . . .

. . . said to have efficiency of 95 percent on 0.3 micron particles, and of 99 percent by discoloration test using atmospheric dust—*Cambridge Filter Corp., Dept. HPAC, 738 E. Erie Blvd., Syracuse* 1, *N. Y.*

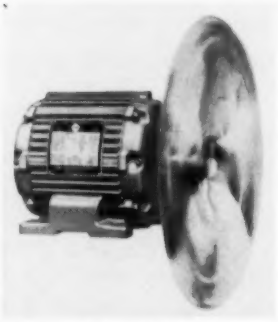
"Micretain" filter operates at initial pressure drop of 0.4 in. water gage. Glass asbestos filter medium with Kraft separators gives capacity of 1000 cfm in face area of 24 × 24 in. and a filter depth of 11½ in.



Plastic Coated Valves . . .

. . . developed to improve corrosion resistance of cast iron valve—*DeZurik Corp., Dept. HPAC, Sartell, Minn.*

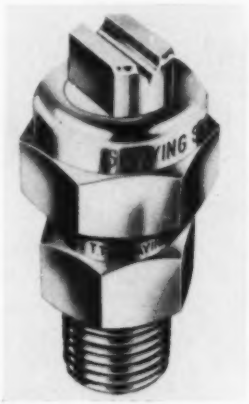
Plastic coatings of valve make it suitable for neutral salt solutions, alkalies, alkaline salts, mild acids, other services. Plug pivoted eccentrically in valve body to match eccentrically raised seat; plug touches valve body only when valve is closed.



Air-Over Fan Motors . . .

. . . available in ratings from 1 to 125 hp—*Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

Air-over fan motors designed for quiet operation in ventilating systems, exhaust systems, cooling towers, air moving installations where motor drives propeller or axial flow fan. Motors available with foot or flange mountings in totally enclosed and explosionproof enclosures suitable for vertical or horizontal mounting.



Atomizing Nozzles . . .

. . . designed for applications requiring flat atomized spray at exactly controlled and low volume—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

New "0011 Series" nozzles have rated capacity of 2/3 gph at 40 psi. Three different spray angles available. Nozzle orifice dimensions equivalent to 0.009 in. diam.

Plastic Flow Tubes . . .

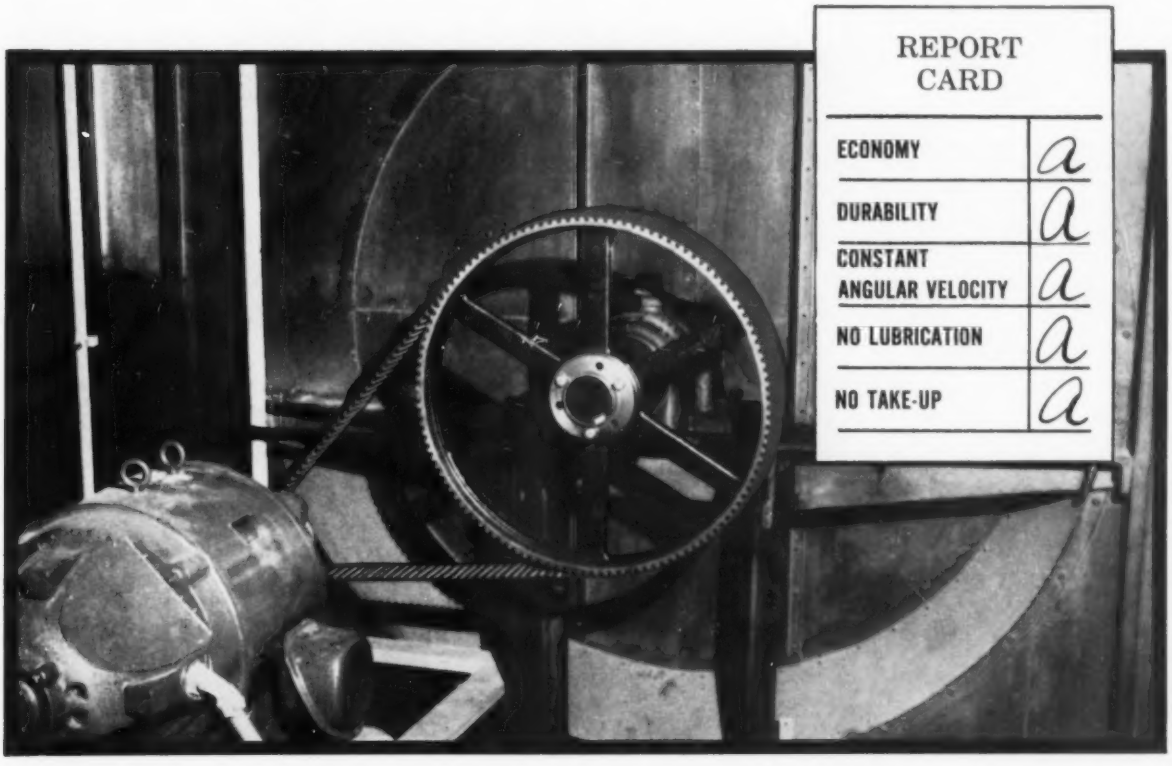
. . . in line including sizes between 4 and 48 in.—*B-I-F Industries, Inc., Dept. HPAC, 345 Harries Ave., Providence* 1, *R. I.*

Plastic flow tubes designed for ease of installation between pipe flanges in industrial and chemical applications—wherever acids, alkalies, slurries, gases require metering. Flow tube made of glass fiber reinforced epoxy or polyester resins with metal-

(*Continued on page* 186)

US RUBBER **PowerGrip** "TIMING" BELTS

"PowerGrip goes to school and gets grade 'A' marks"



In September, 1957, a total of seven U. S. PowerGrip "Timing"® Belts (⅞", pitch XH) were installed on exhaust fans in Kalamazoo Central High School.

These belts replaced flat belt drives. V-Belt drives would have required installation of "jack" shafts to achieve double reduction in the ratios. PowerGrip "Timing" Belts eliminated this, *cut costs sharply.* The Kalamazoo Central High School gives PowerGrip straight A's in economy, durability, steady grip and all-around performance.

PowerGrip is built with teeth that fit into the pulleys, hence no slippage, no friction, no lubrication, no take-up. PowerGrip "Timing" Belt, with its amazing efficiency, is built in the world's largest and most modern factory that makes endless transmission belts.

• • •

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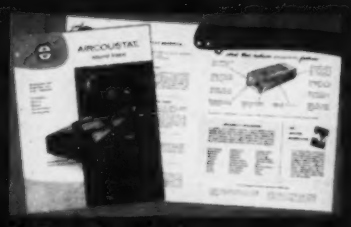
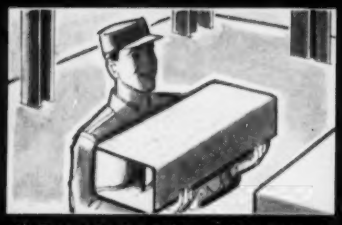
7 ways AIRCOUSTAT® can save you time and money

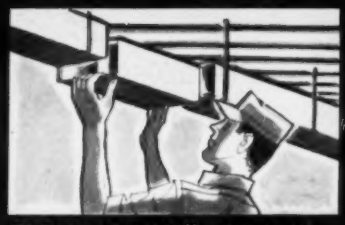
Sound Traps . . . with Guaranteed Results



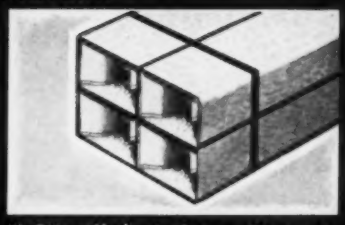
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



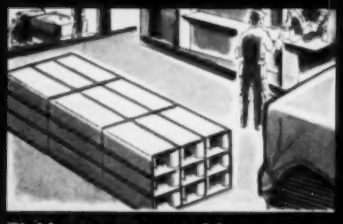
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



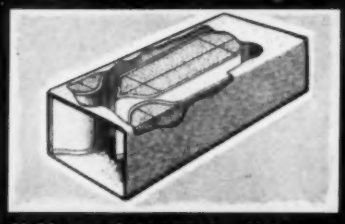
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.

7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3407 Scott Street, Baltimore 3, Maryland.

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SOUND CONTROL

METAL PRODUCTS DIVISION

Engineered **Products Sold with** ***Service***

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A COMPLETE NEW LINE OF

SHAFCONAIRE

SUSPENDED *GAS FIRED* FURNACES

priced to give you a competitive advantage in the commercial and industrial heating markets!

Another "*First*" for Shafconaire! A new line of suspended gas-fired furnaces designed *right* built *right* for commercial-industrial use—and *priced right*, too, to give you profitable, volume sales! For these new Shafconaires actually cost less than any other type of gas heating equipment of equal capacity on the market today. What's more, they're covered by all required approvals for immediate installation.

4 OUTSTANDING FEATURES for Profitable Volume Sales

- **Power Burner**—provides closer control of gases through heat exchanger—gives greater heating efficiency and lower heating costs.
- **Large Capacity**—designed to handle greater volume of warm air at higher velocity—can be easily connected to duct work to provide controlled distribution of heat.
- **Maximum Head Room**—approved for installation two inches from combustible materials, compactly designed to assure greater clearance.
- **Versatility**—quickly, easily adapted in the field for right hand or left hand installation.

AVAILABLE IN 6 BASIC MODELS TO GIVE YOU BROAD MARKET COVERAGE

85,000 — 97,000 — 112,000 — 142,000 — 182,000 — 252,000 BTU Output

In addition to these six basic models, Shafconaire Gas-Fired Furnaces can also be supplied for duct heater applications. All models are furnished complete with power burner, blower, controls and with or without filters as desired.

SHAFCONAIRE—*the Specified Line for '59!* More national chain organizations have specified Shafconaire this year than ever before. So get your share of this profitable "pre-sold" volume—send coupon today for specifications and prices on the entire line of Shafconaire Suspended Furnaces.

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Executive Offices: 1612 Book Bldg. • Detroit 26, Mich. • WO 2-4647
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20 years exclusive experience in the design and manufacture of suspended heating equipment

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Please send complete specifications and price information on your entire line of Shafconaire Suspended Gas-Fired and Oil-Fired Furnaces.

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SABER-TOOTH
DRILL-N-ANCHOR

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Anchor anything to concrete—easily, quickly, permanently—with Saber-Tooth, sure-holding heavy-duty masonry anchor that drills its own hole.

Put steel expander plug in drill end of Saber-Tooth, drive home... anchor expands over plug, at bottom of hole for greatest holding power.

See for yourself how easily you can anchor anything to concrete—send the coupon for free sample Saber-Tooth and full information.

It's a drill...and drills its own hole fast, even in hard concrete, with power-operated or hand hammer. Saber-Tooth's core action drills quickly. Drill and anchor are one...matching sizes is no problem. Save the cost of special drills, the time it takes to use, store and sharpen them.

It's an anchor...and holds fast: engineering tests demonstrate holding power up to 17,860 lbs. As you drive it into hole, anchor expands over plug...holding ridges around body resist pull-out. Saber-Tooth anchor withstands severe shock and vibration...double plating protects against rust, corrosion.

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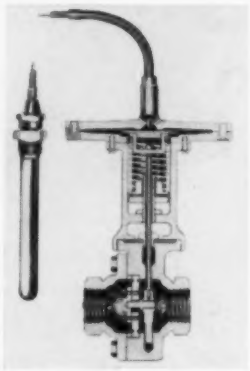
252 Petersville Road New Rochelle, N.Y.
Please rush my Saber-Tooth sample and complete facts.

Name.....
Firm.....
Address.....
.....
R4

EQUIPMENT DEVELOPMENTS
Continued

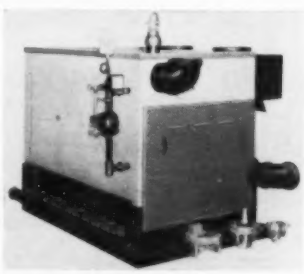
lic throat lining; available in variety of sizes and flange and throat materials.



Control Valve . . .

. . . in newly redesigned line—*OPW Corp., Div. of Jordan Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati 13.*

Redesigned, sliding gate, self-operated "No. 180" temperature control valve has following features, according to manufacturer: removable thermal system to allow field changing of temperature control ranges without affecting valve stroke; concealed screws and vertical capillary designed to provide tamperproof thermal system; plastic gasket on bulb for tight seal and plastic washer with adjusting wheel for smoother set point adjustment. Available in sizes ¼ through 2 in. with bodies of cast iron, bronze, ductile iron, aluminum or monel. Rated for temperatures 35 to 450 F, and pressures to 250 psi.

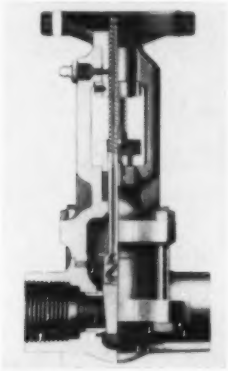


Gas Fired Boiler . . .

. . . with new utility jacket—*Peerless Heater Co., Dept. HPAC, Boyertown, Pa.*

EQUIPMENT DEVELOPMENTS
Continued

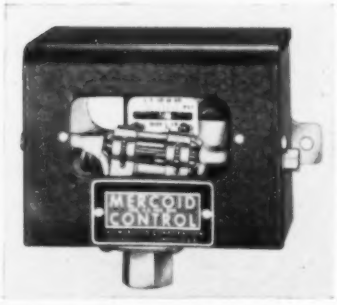
"Series 150" large industrial gas fired boiler has high quality, gage steel used in utility jacket. Jacket can also be installed after boiler is completely assembled. Line available in 33 sizes rated from 600,000 to 5,400,000 Btu per hr input, for use with all types of gases.



Gate Valves . . .

. . . in sizes ½ to 2 in.—*Ohio Injector Co., Dept. HPAC, 275 Main St., Wadsworth, Ohio.*

"Pipe-Pal" ductile iron gate valves rated at 1000 psi for all temperatures from −20 to 650 F. Ductile iron said to have great strength, shock and impact resistance, corrosion resistance.



Pressure Controls . . .

. . . designed for applications involving air or gases (not injurious to steel or silver solder)—*Mercoid Corp., Dept. HPAC, 4201 Belmont Ave., Chicago 41.*

"Type AP-153" has operating range 1 to 20 psig; differential (fixed) 0.5 psig; maximum pressure 30 psig. Features cited: operating point set by external adjustment; vis-

Life in these excited states...

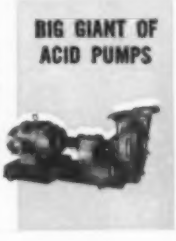
"I've chipped off all the rust, Chief, but don't the walls seem kind of thin?"

Corrosion makes profits thin, too

If corrosion and contamination are eating into your profit margin, you need chemical-resistant equipment by American Hard Rubber Company. Look today to see where you can use Ace rubber and plastic pipe, valves, pumps, tanks and special parts. It doesn't cost . . . it pays!

Ace chemical-resistant rubber-lined steel pipe best for high-pressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".

Highly efficient *WE* pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.



Design assistance and facilities for molding special fittings, pump parts, etc., of plastics or hard rubber. Also large hand-fabricating facilities.

Variety and quality to match *any* plastic piping. Riviclor PVC, Ace-Ite rubber-plastic, Parian poly, Ace Saran, Tempron high temperature nitrile, hard rubber-lined steel.

ACE processing equipment of rubber and plastics

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EQUIPMENT DEVELOPMENTS

Continued

ible calibrated dial with pointer; visible hermetically sealed mercury contact; repetitive trip point.

Vibration Isolation . . .

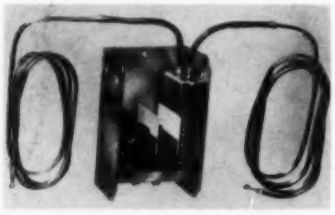
. . . incorporating steel springs as vibration, shock absorbing medium—*Korfund Co., Inc., Dept. HPAC,* 48-01 *F 32nd Pl., Long Island City* 1, *N. Y.*

"Type LR" mount intended for use with fans, cooling towers, furnaces, piping, packaged air conditioners, air handling units. Rubber housed mounting can carry load 150 to 1400 lb per isolator. Minimum operating height of 4 in.

Roof Ventilators . . .

. . . designed for quiet operation—*Swartwout Co., Dept. HPAC,* 18511 *Euclid Ave., Cleveland* 12.

"Fiber-Aire" units provide capacities from 180 to 13,500 cfm. Bonded glass fiber housings said to be virtually indestructible, absorb noise and vibration in operation.



Temperature Controllers

. . . in dual operation models—*Automatic Devices Co., Inc., Dept. HPAC,* 711 *Hillgrove Ave., Western Springs, Ill.*

"Weather-Flo" combination provides indoor-outdoor reset control arrangement of heat flow for winter heating, and an extended tubular bulb type thermostatic controller for summer air conditioning control. Another form provides control of fan action in warm air installations or circulator action in hot water installations in combination with indoor outdoor reset control of burner action.

Portable Compressor . . .

. . . in completely new design—*Ingersoll-Rand Co., Dept. HPAC,* 11 *Broadway, New York* 4.

Portable 125 cfm "Gyro-Flo" rotary compressor is 10 ft, 1 in. long, including drawbar; 5 ft, 1½ in. high, 5 ft 8¾ in. wide; weighs 2442 lb. Power supplied by 1800 rpm gasoline or diesel engine. Features cited: automatic drainage of oil from cylinders when unit is shut down; safety shutdown on compressor; provision for inspection of all rotor vanes; fuel, air tanks under housing and lockable cover.

FIRST and ONLY FIRE DAMPER

TO RECEIVE THE UNDERWRITERS' LABORATORIES APPROVAL

This acceptance by the UNDERWRITERS' LABORATORIES came only after extensive tests with FIRE DAMPERS constructed according to the present Bulletin No. 90 SERIES, which failed to pass the test, and the IMPERIAL DAMPER No. VWNYT-1, which passed the test, and now carries the UNDERWRITERS' LABORATORIES LABEL.

We, also, at this time, proudly announce the APPROVAL AND LABELING of the IMPERIAL DAMPER No. VWNYT-1 by the BOARD OF STANDARDS AND APPEALS FOR USE IN NEW YORK CITY. This is the FIRST AND ONLY DAMPER to date to carry this approval and label.

Send for Our New Informative Brochure!

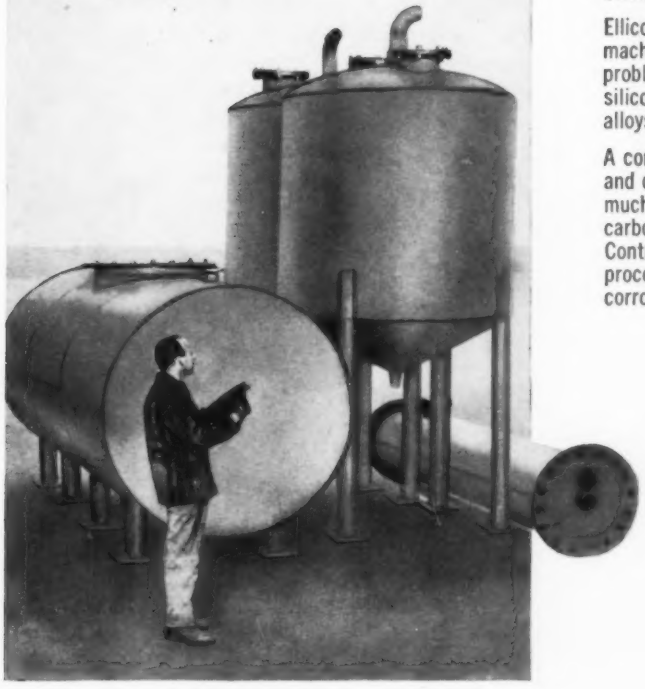
IMPERIAL DAMPER COMPANY

Manufacturers of Volume Dampers, Multi-Blade Dampers, Automatic Dampers, Automatic Shutters, Back-Draft Shutters, Louvers, Stationary and Adjustable Extruded Aluminum Louvers.

664 EDGECOMBE AVENUE
NEW YORK 32, N. Y.
LORRAINE 8-9100

Specify ELLICOTT Storage and Processing Vessels

WITH CUSTOMIZED CORROSION CONTROL



Stop Corrosion from contaminating products before it starts by specifying Custom Corrosion Controlled Processing and Storage Vessels by Ellicott.

Ellicott, through many years of experience in fabricating and machining metals, has successfully solved many corrosion problems by utilizing non-ferrous metals such as copper silicon, aluminum and cupro-nickel as well as steel and its alloys, including the higher tensile steels, stainless and clads.

A complete line of Novelon Linings of cement, rubber, lead and copper, together with the new plastic linings that allow much higher heat resistance, can be applied to low-cost carbon steel. Ellicott vessels with Customized Corrosion Control can solve the corrosion problems in storing and processing water, acid, food and chemicals. Send us your corrosion problem today. Representatives in major cities.

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FABRICATORS INC.

Subsidiary of Ellicott Machine Corporation
CLARE & KLOMAN STS. • BALTIMORE 30, MD.

Another CAINS COIL OF PROFIT
INSTANT-VANE RAIL
ELIMINATES
Layout—Tab Cutting—Hole Punching —Spot Welding—Riveting—Etc. Results in a Savings Up to 70% over old methods.
Best method ever devised for installing Turning Vanes (single or double) in sq. elbows. In coils. Pull out, shear off—insert vanes and peen with hammer. No valuable time lost.
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The solution to
BULK TANK PREHEATING
REMPE "HOT SPOT" PREHEATER
Heats with either steam or hot water
Heats liquids in bulk storage to proper flow temperature, *before* they enter the suction pipe.
Special design "flow accumulator" causes liquids to pass over heated coils. Does the job efficiently and at low cost.
Construction — All-steel shell and coil assembly. Connections furnished for any diameter tank.
WRITE FOR BULLETIN
HEAT TRANSFER EQUIPMENT
REMPE CO.
Founded 1890
REMPE COMPANY
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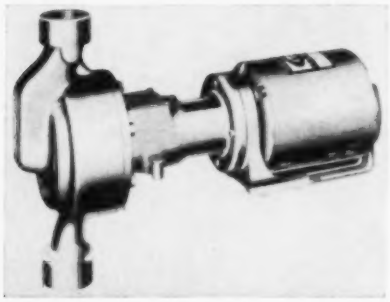
EQUIPMENT DEVELOPMENTS

Continued



Pump . . .

. . . designed for heating and/or cooling, boosting water pressure and recirculating hot water applications—*Taco Heaters Inc., Dept. HPAC,* 1160 *Cranston St., Cranston* 9, *R. I.*

New pump series available in six sizes and with single or three phase non-overloading motors. Features cited: in-line installation; cast iron or bronze construction; closed, one-piece impellers; stainless steel shafts; slinger ring lubricated sleeve bearing; heads to 45 ft. flows to 55 gpm; rubber coupling; ceramic and carbon mechanical seal; rubber mounted motors.

Dust Collector . . .

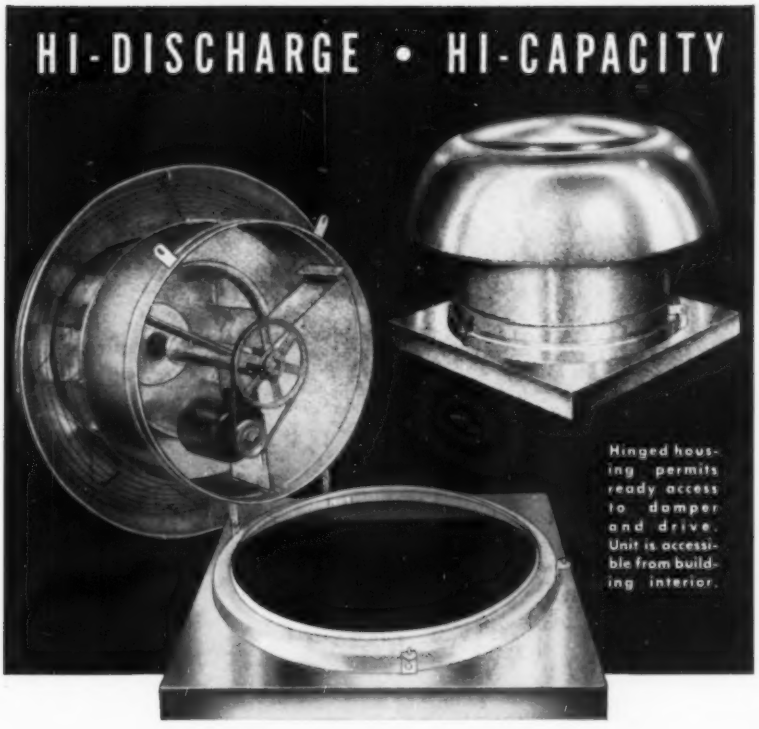
. . . developed for industrial operations where volume of air to be handled is unusually high—*Aget Mfg. Co., Dept. HPAC,* 1408 *E. Church St., Adrian, Mich.*

"Filterkop" dust collector consists of heavy gage steel housing, hopper, 80 cloth filter tubes, shaker mechanism. Accumulated dust automatically shaken from tubes into hopper at end of each fan operation. Dust collector may consist of single unit or any multiple, according to plant requirements. One shaker serves two units; one air inlet and one air outlet needed.

Offset Wrench . . .

. . . designed for use on special piping applications in tight quarters—*Ridge Tool Co., Dept. HPAC, P. O. Box* 670, *Elyria, Ohio.*

"Ridgid No. E-110" offset hex wrench has jaws designed to fit narrow nuts, slip into tight places. Jaws have maximum opening across flats of $2\frac{1}{8}$ in., will handle drain nuts through $1\frac{1}{2}$ in. "No. 9" model handles sizes $\frac{1}{4}$ through $\frac{5}{8}$ in.; "No. 35" for sizes 1 to $2\frac{3}{4}$ in.


HI-DISCHARGE • HI-CAPACITY
Hinged housing permits ready access to damper and drive. Unit is accessible from building interior.

...new JENN-AIR "HI-D" Power Roof Exhausters

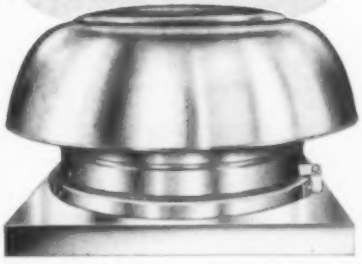
When specifications call for an exhaust fan with BIG air moving capacity, they call for Jenn-Air's new "Hi-D" Power Exhausters. Designed in both axial and centrifugal wheel models, these belt drive units offer capacity ratings in a broad range from 480 to 28,650 cfm.

In addition to high capacity, Jenn-Air "Hi-D" Exhausters provide these important design features:

- Wheel is located above motor to combine high discharge point with an overall installed height lower than any comparably-rated exhauster.
- Non-overloading wheel, made of heavy gauge aluminum, is dynamically and statically balanced in the Jenn-Air Sound Laboratory.
- Exclusive guide vane construction improves air moving efficiency while minimizing turbulence and noise.
- Adjustable motor pulley permits speed variation.
- Totally enclosed motor and tubular drive assembly feature permanently sealed, pre-lubricated ball bearings. Motor is effectively cooled by air stream.
- Bird guard of heavy gauge stainless steel is an integral part of every unit.
- Maintenance-free aluminum housing provides strength without weight.

The HAB Series of "Hi-D" Exhausters (axial blade) gives highest air-per-dollar value in short duct runs where static pressures are negligible. The HCB Series (centrifugal wheel) effectively overcomes static pressures and is usually preferred for long duct runs. Its smaller diameter permits a corresponding reduction in duct size.

JENN-AIR All-Aluminum LOW-CONTOUR RELIEF VENTS

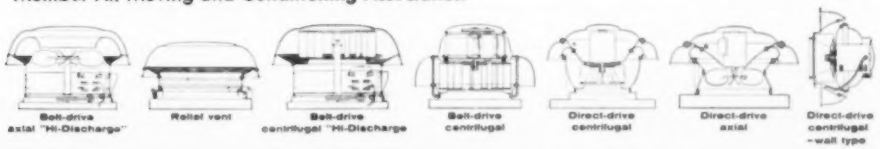


For fresh air intakes or pressure relief within buildings, specify Jenn-Air relief vents. These high-discharge units are designed in seven sizes . . . built to handle from 356 to 18,350 cubic feet per minute. Weather proof, bird proof Jenn-Air relief vents eliminate unsightly goosenecks and hoods.

Specially designed hinge on housing permits ready access to damper. Simple locking mechanism keeps unit tightly closed.

Ask your Jenn-Air representative for performance and dimensional data on the complete line of Jenn-Air Power Exhausters and Relief Vents.

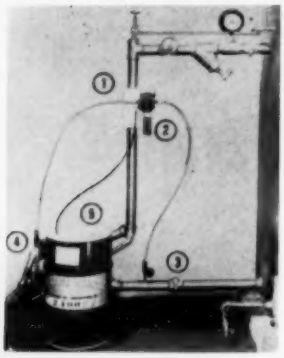
Member Air Moving and Conditioning Association



JENN-AIR

Jenn-Air Products Company, Inc. • 1102 Stadium Drive, Indianapolis 7, Indiana

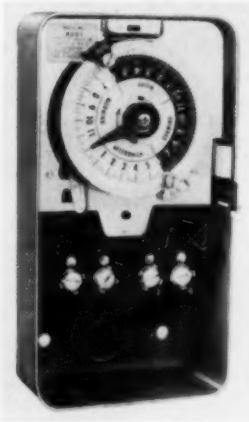
EQUIPMENT DEVELOPMENTS
Continued



Water Treatment . . .

. . .designed to provide continuous, automatic proportioning of liquid chemicals in treatment of cooling tower water to prevent corrosion, scale formation—*Bird-Archer Co., Dept. HPAC, 4337 N. American St., Philadelphia 40.*

"Automatic Micro Feeder" water treatment system said to eliminate need for daily changing of chemicals; feeder supplies as little as 1/10 to 1 gal of chemical into circulating water every 24 hr. Recommended for use with cooling towers of up to 400 tons capacity in normal operation.



Time Switch . . .

. . .developed for applications with pumps, blowers, motors, heating and air conditioning equipment, signal systems, other industrial and central station uses—*Paragon Electric Co., Dept. HPAC, Two Rivers, Wis.*

New "4000 Series" 40 amp, tungsten-rated time switch has quick-set dial using trippers, and is calibrated in 15 minute sections, subdivided into 6 hr quadrants. Omitter device available in all switch arrangements for skip-a-day applications. Switch is 7¾ in. high, 4¼ in. wide, 3 in. deep; weighs 2 lb, 10 oz.

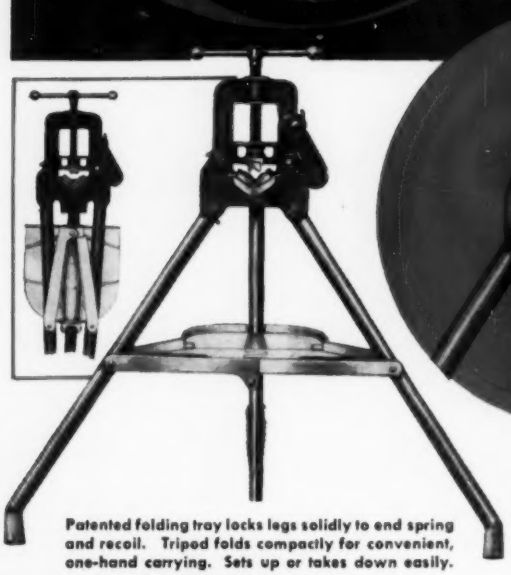
Pipe Joint Tape . . .

. . .designed to seal, permanently lubricate pipe joints—*Minnesota Mining and Mfg. Co., Dept. HPAC, 900 Bush Ave., St. Paul 6, Minn.*

Chemically inert "Scotch" brand pipe sealant tape, "No. 547," available in 3 and 4 mil calipers, can be

REED

PORTABLE *Folding Tray* TRIPOD VISES



Patented folding tray locks legs solidly to end spring and recoil. Tripod folds compactly for convenient, one-hand carrying. Sets up or takes down easily.

Improved Chain Vise features a convenient side handle which ends fumbling or skinned knuckles. Capacity from ⅛" to 4" makes it ideal for construction or maintenance work.

Now available with a new and better Chain Vise or the long-jaw Yoke Vise

Reed Folding Tray Tripods are well known for their work-saving solidity and the ease with which they can be carried, set up or taken down.

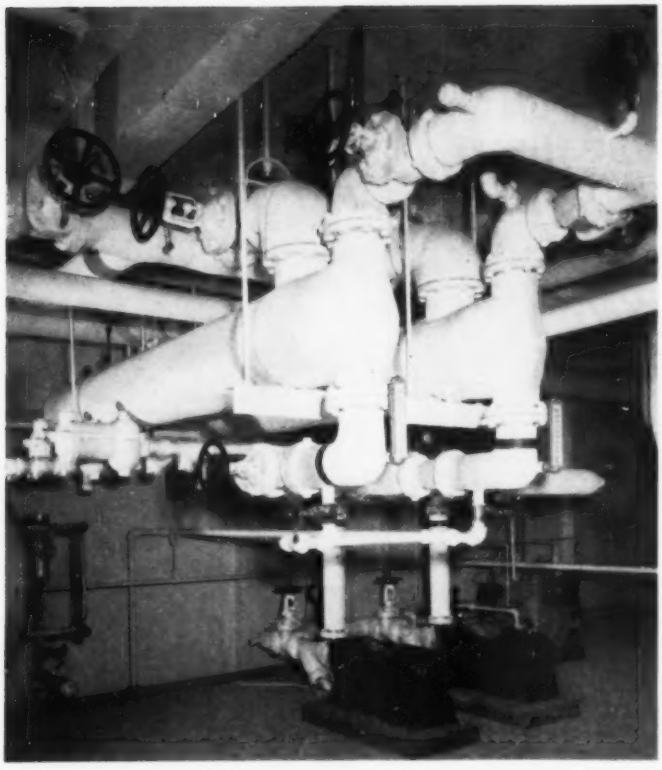
The Chain Vise Model is easy and convenient to use because the handle is at the side where you can turn it easily and naturally. The chain drops into position even on 4" pipe. You never have to hold it with one hand while you tighten with the other. Hardened vise jaws have three faces for triple life.

The Yoke Vise Model features the patented Reed long-bearing alloy steel jaws which provide a "wrench" action . . . so that a slight handle pressure holds any pipe from ⅛" to 2½". Reversible lower jaws. Special features to end lost motion.

Ask your jobber or write for free literature.

REED MANUFACTURING COMPANY
ERIE, PENNSYLVANIA
TRADEMARK

HOT WATER BY WHITLOCK



Whitlock Convertors supply hot water needs in the attractive new building of the Hartford, Connecticut, Public Library.

Whitlock Convertors are giving excellent service in many of today's fine buildings . . . large and small. Rugged and compact in design, they include many details requested by consulting engineering offices. They are economical to operate, having maximum water velocities consistent with minimum pressure drops. They are also easy to install and maintain. For most applications we can supply *standardized* convertors.

Whitlock Type R Convertors, in a wide range of sizes and capacities for typical pressure, are widely used for space heating systems. Our long experience in designing and manufacturing convertors and other water heaters can be very useful when you're selecting and specifying such equipment. We will gladly assist you with any water heating problems . . . Convertors Bulletin 62 on request.

Whitlock

DESIGNERS AND BUILDERS OF BENDS, COILS, CONDENSERS, COOLERS, HEAT EXCHANGERS, HEATERS, PIPING, PRESSURE VESSELS, RECEIVERS, REBOILERS.

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The Cambridge AEROSOLVE® Filter is the RELIABLE Filter

- High Efficiency
- Positive Filtration
- Low Pressure Drop
- Easy Installation & Maintenance
- High Velocity — 450 FPM
- Expert Technical Assistance

Be specific about filter efficiencies

Compare!

EFFICIENCY — STANDARD TESTS

TYPE FILTER	WEIGHT TEST (Synthetic Dust)	NBS TEST # METHOD (Atmospheric Dust)	DOP TEST (0.3 Micron Smoke)
Cambridge ABSOLUTE®	*	*	**99.97 Min.
Cambridge MICRETAIN	*	99	95
Cambridge AEROSOLVE® 95	*	90-95	80-85
Cambridge AEROSOLVE 85	99	80-85	50-60
Cambridge AEROSOLVE 35	96	30-35	20-30
Electronic Precipitator	99	85-90	60-70
Pleated Paper	94	25-30	15-20
2" Cleanable	76	8-12	2-5
2" Throwaway	76	8-12	2-5

*Practically 100%. Test not practical for more accurate reading.
#National Bureau of Standards Discoloration Test.
**Maximum Allowable Penetration of Dioctyl Phthalate Smoke 0.03%. Every filter individually tested.

Cambridge AEROSOLVE cartridges of 95%, 85% and 35% efficiency are all interchangeable for easy adjustment to future efficiency requirements.

Write for Bulletin 132

Cambridge Filter Corporation®
732 E. Erie Blvd., Syracuse 1, N. Y.

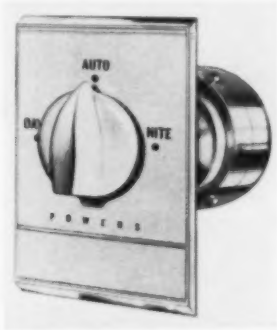
Pioneers in High Efficiency Air Cleaning

REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

Continued

applied in seconds to conform to all types of pipe threads, fittings, according to manufacturer. Made with plastic "TFE-fluorocarbon resin, said to withstand processing temperatures from liquid oxygen range through that of super-heated steam. White tape available in 36 yard rolls in ¼ to 8 in. widths.



Selector Switch . . .

. . . designed to direct or stop flow of compressed air to pneumatic motors and valves—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

Plastic disc now used in switch body to reduce friction, reduce air leakage. Selector switch can be used to divert control of air operated system from one instrument to another, to control system of valves, dampers, pneumatic electrical equipment with positive action, change system air supply pressures.

Air Filters . . .

. . . developed for applications with furnaces and air conditioners—*Fram Corp., Dept. HPAC, Providence 16, R. I.*

$12,000 SAVED

on one remodeling job

This high-capacity coil did the trick!

"Modine chilled-water AIRditioners saved us $20 on each of our 600 units!" That quote comes from the spokesman for a recently remodeled office building after he had conducted tests on five competitive makes.

Modine's exclusive high-capacity coil *required smaller piping* than any of the others. Therefore, most of the building's existing piping could be used . . . with corresponding savings on fittings, valves and pumps.

In new buildings, too, Modine's high-capacity coil means economy. Within allowable pressure drops, Modine units surpass the heating and cooling output of equivalent-sized competitive models.

OTHER POPULAR MODINE AIR CONDITIONING UNITS

"LOW-BOY" (Chilled-Water)

SELF-CONTAINED AIRDITIONER

MAIL THE COUPON for complete details on all Modine AIRditioners — console, ceiling and concealed overhead and in-the-wall types . . . ⅔ to 2 tons.

Modine
MANUFACTURING COMPANY

MODINE MANUFACTURING CO.
1509 DeKoven Ave., Racine, Wis.

Please send AIRditioner Bulletin 757

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A-1384

7 OUTSTANDING ADVANTAGES OF NON-CLOG SEWAGE PUMPS

from "Chicago"

1. 50 years of pump manufacturing experience.
2. Enclosed, balanced impellers passing large spheres provide quiet operation with high pump and high non-clogging efficiency.
3. Expansion joints in discharge pipe prevent pump distortion and resulting bearing failures.
4. Simple, dependable micrometer adjustment permits easy setting of impeller clearance in pump casing to compensate for normal wear, maintaining maximum efficiency.
5. Heavy ball thrust bearings are located well above floor level to prevent water splashing into bearings.
6. Packing boxes built into floor plates prevent leakage.
7. Heavy duty shafts and bearings eliminate vibration and provide long life.

FOR . . . handling sewage and drainage in buildings and industrial plants and for municipal sewage disposal.

SIZES . . . available in sizes from 4" to 8", with capacities from 50 to 1250 G.P.M.

Now available with *the new* SEALTRODE* Sealed Electrode Floatless Pump Controller . . . the *only* Controller featuring completely sealed Electrodes . . . positively preventing insulation or coating by grease or other corrosive elements.

Over 50,000 installations.

Write direct or contact Chicago Pump Company Distributors located in most principal cities for Bulletin 124-F and complete engineering data.

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1959 50 YEARS CHICAGO PUMP COMPANY 1909

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

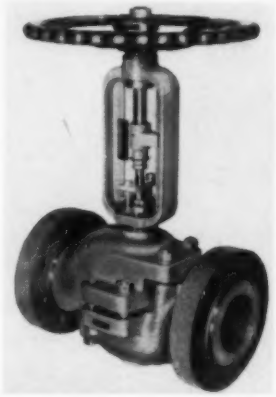
Chicago Pump Company

622C DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

EQUIPMENT DEVELOPMENTS

Continued

New air filters said to remove 90 to 98 percent of all germs reaching filter, and kill more than 99 percent of these. Germacidal agent used in filters is called "Permachem." Agent is used in air filters under license from its producer. Especially recommended by air filter manufacturer for applications in hospital and health buildings.



Control Valves . . .

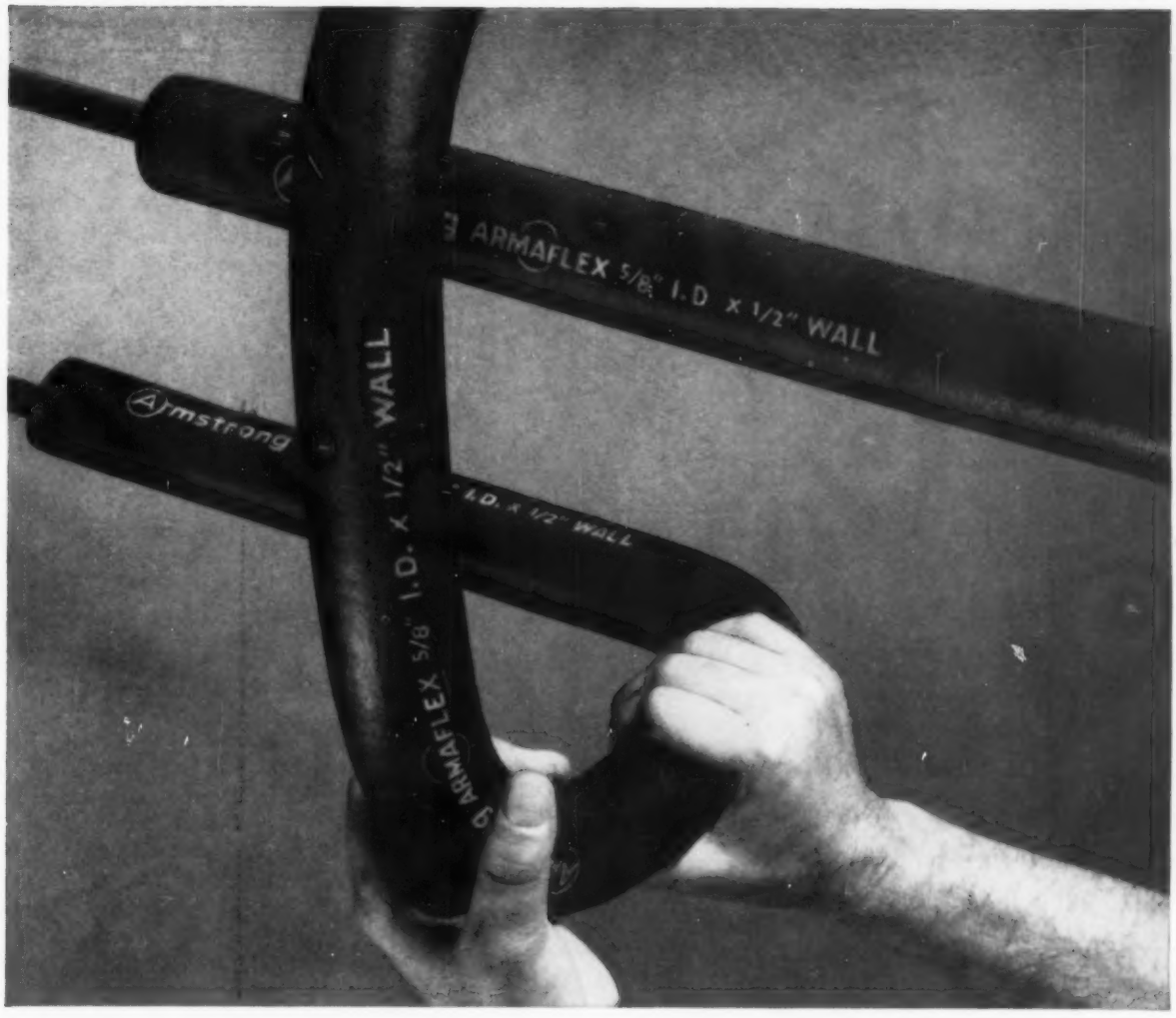
. . . developed for dealing with corrosion, erosion problems using "hard to handle" process fluids—*Conoflow Corp., Dept. HPAC,* 2100 *Arch St., Philadelphia* 3.

"Series LM" handwheel operated control valve has single-seated valve body with thick body walls cast to 600 psi ASA rating; available in ductile iron, steel, bronze, many high alloys. Available in range of sizes from $\frac{3}{4}$ to 6 in. with separable or integral flanges.

Noise Survey Meter . . .

. . . designed to monitor and measure noise hazards—*Mine Safety Appliances Co., Dept. HPAC,* 201 *N. Braddock Ave., Pittsburgh* 8.

Noise survey meter developed for rapid, multi-location measurement of sound levels to establish noise-contour "maps" in large industrial plants. Recommended by manufacturer for use with "Soundscope", an instrument to measure energy distribution of sound within narrow frequency band.



An Armstrong Armaflex specification means a low-cost, dependable pipe insulation job

A lot of pipe insulation specifications have become old-fashioned since Armstrong Armaflex was introduced less than four years ago. In that short time, this flexible foamed plastic material has moved from the specialty class to a position of major importance in the insulation field.

The reason is simple. With Armaflex you get a neater, faster, lower cost, more dependable job than with traditional pipe insulations. Armaflex is recommended for all piping operating from 0° to 200° F. It is made in three thicknesses and in sizes up to 3" IPS. Larger piping and equipment can be insulated with Armaflex sheets.

If you would like to compare your current pipe insulation specifications with the Armstrong Armaflex recommendations, send for the specification booklet today. This 12-page booklet contains complete Architects' and Engineers' Specifications and recommended Installation Instructions for the Contractor. Mail the coupon for your free copy.

Armstrong INSULATIONS

MAIL COUPON TODAY

Armstrong Cork Company
2207 Sherman St.
Lancaster, Penna.

Please send me complete specifications on Armaflex without cost or obligation.

Name _____

Company _____

Street _____

City _____ Zone _____ State _____

Four Good Reasons For Installing

GOODALL RUBBER EXPANSION JOINTS

Goodall Expansion Joints have not only the advantages stemming from the natural characteristics of rubber for all types of installations, but, what's more important, they have back of them Goodall's engineering skill, manufacturing experience and reputation for quality that give *added* assurance of exceptional service under all conditions.

EASIER TO INSTALL...

Goodall Rubber Expansion Joints are quickly, easily installed on new construction or as replacements. They are light in weight to facilitate handling, with short face-to-face dimensions for easier application where space is limited. Retaining rings are quickly aligned and bolted. No gaskets are required.

RESPONSIVE TO MINIMUM PRESSURE...

With Goodall Rubber Expansion Joints only the slightest pressure is required to create movement in any direction. Result—stress on metal pipe or other member is eliminated or, at most, reduced to an absolute minimum.

MANY SIZES...HIGH WORKING PRESSURES...

Goodall Rubber Expansion Joints are available in sizes from ⅜" to 96" I.D., in all required styles and constructions. Working pressures range up to 125 P.S.I. for Pressure Joints, and to 90 P.S.I. for Vacuum-Pressure Joints, depending on size.

LONGER SERVICE LIFE...

Goodall Rubber Expansion Joints last longer in service because of inherent characteristics of the material from which they are made. There is no embrittlement... continuous movement (flexing) actually keeps the rubber joint "alive". There is no corrosion or electrolysis. Resistance to abrasion is exceptionally high. Replacement costs are lower.

"If it's GOODALL, it MUST be Good"

Contact Our Nearest Branch or Write for Catalog

Standard of Quality—Since 1870

HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

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GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

EQUIPMENT DEVELOPMENTS

Continued

Baseboard Radiation . . .

...with snap-in hangar installation —*Axeman-Anderson Co., Dept. HPAC, Willaimsport, Pa.*

Installation of "Hydro-Ray" baseboard accomplished through system of hangars, snap. locks; no bolts, screws required. Aluminum fins bonded to ¾ in. copper tube element; 62 fins per lineal ft provided. Bulletin available from manufacturer describes units.

Roof Ventilator . . .

...designed for high capacity duct and flue exhaust applications—*Hg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago* 41.

Three new models added to "Type L-CRF" line of airfoil centrifugal power roof ventilators, increasing capacity to 11,000 cfm. Units have durable, weatherproof housing of heavy gage spun steel; roof is aluminum.

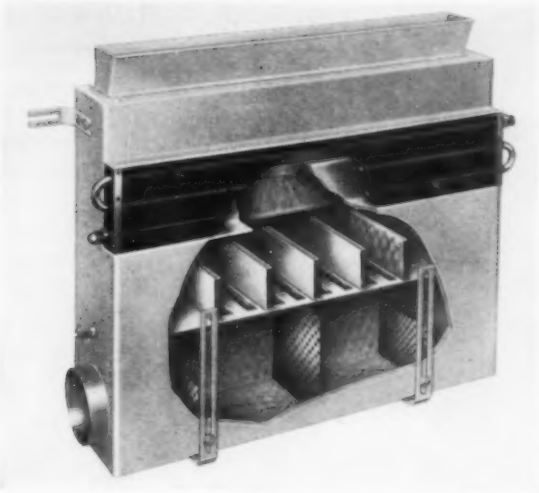
Compression Coupling . . .

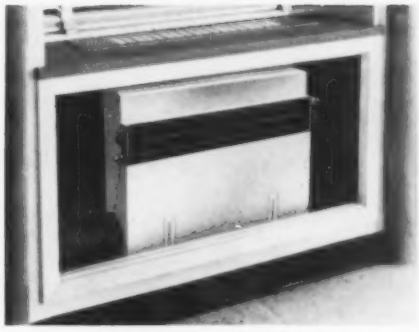
...said to eliminate need for threading when joining two pipes together —*Joslyn Mfg. and Supply Co., Dept. HPAC, 155 N. Wacker Dr., Chicago.*

"Type 210" permanent, pre-assembled compression coupling available in sizes from ⅜ to 2 in. pipe. Pipe ends to be joined are slipped inside of steel sleeve, and two compression nuts tightened with 10 or 12 in. wrench.

Pipe Locator . . .

...with single turn transmitting and receiving coil cast into glass fiber case—*Gardiner Electronics Co., Dept. HPAC, 2545 E. Indian School Rd., Phoenix, Ariz.*





Furred-in arrangement permits custom matching of building architecture. Recirculation grille supplied with frame to facilitate plastering-in. Cabinet enclosures which can be painted to match room décor also available.

New Carrier 37E All-Air Weathermaster

—only high-velocity terminal with reheat coil!

Simplicity is the keynote of the new Carrier 37E All-Air Weathermaster*, the only room terminal currently available which provides a reheat coil for high-velocity constant volume single duct systems. These units require no electrical connections, no motors or other moving parts, no filters or condensate drains. And they save valuable building space because they permit the use of compact high-velocity air distribution systems.

Installation is made easy by a choice of right or left hand duct connection, right or left hand connection to the heating coil (steam or hot water, 3 or 5 row), and by the availability of a complete line of accessories for cabinet or furred-in arrangements.

The single duct system with reheat at the unit is acknowledged to be functionally the best possible for maintaining close control of conditions in individual rooms of office buildings, hospitals, hotels, and similar structures, new or old. It is an ideal choice for modernization of a building where the design sensible cooling load is relatively low and where a serviceable steam or hot water heating plant is available.

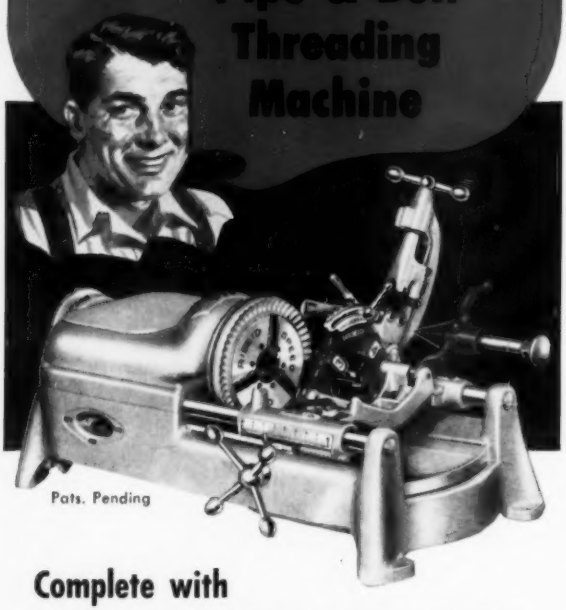
In addition to the 37E, there's a new Carrier 37D All-Air Weathermaster for double duct systems. For complete information about the new units, call your nearest Carrier office. Or write Carrier Corporation, Syracuse 1, New York.

*Reg. U.S. Pat. Off.

MORE PROOF OF
BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

Checked 'em all . . . got
Far More for My Money
when I bought this terrific new
RIDGID 535
Pipe & Bolt
Threading
Machine



Pats. Pending

Complete with
1 Universal Die Head, 2 Sets of Dies
for ½" to 2" pipe or conduit

Looks good, does better. Perfect cutting, reaming, threading fast . . . and easy! Three tools operate independently . . . swing up out of the way for short pipe chucking from front. Slip-proof Speed Chuck is a great performer. Concealed oil system, automatic shut-off nozzle. Quick-opening die head sets to size right in machine. Power?. . . RIDGID-built motor handles 2" pipe, conduit, bolt, rod—and 12" geared tools easily. Try it, compare it . . . and you'll understand its enormous popularity! Leg and wheel stands available. At your Supply House.

Time-savings on just 3 large jobs more than paid the $460.00 price!

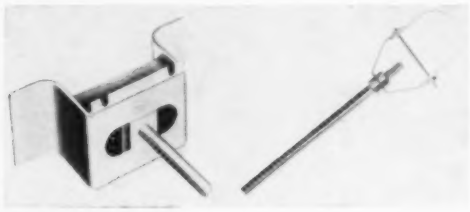
The Ridge Tool Company Elyria, Ohio, U.S.A.

THREADED PIPE . . . It's Tight . . . It's Best . . . Costs Less!

EQUIPMENT DEVELOPMENTS

Continued

Transistorized pipe, valve, cable locator has transmitter, receiver powered by four flashlight batteries, each with average life of 1400 hr. Three transistors used in transmitter, and seven in receiver. Circular available from manufacturer describes product.



Pipe Hangers . . .

. . . available in two types for separate applications—*Fee & Mason Mfg. Co., Inc., Dept. HPAC, Manasquan, N. J.*

Light duty "Universal Concrete Insert" designed to ease installation through notched nailing flanges; through "knockout" plate, which hastens installation of rod, nut. Light duty "Clevis Hanger" developed for low-cost installation in light industrial plants, commercial establishments, air conditioning units, gas, water, steam air lines, etc. Hanger permits vertical adjustment of 1 to 1½ in., depending on size. Available in sizes from ¾ to 4 in.

Power-Assisted Drive Tool . . .

. . . for work on concrete, steel, masonry—*Hilti Rapid Fastening Systems, Inc., Dept. HPAC, 73 Southfield Ave., Stamford, Conn.*

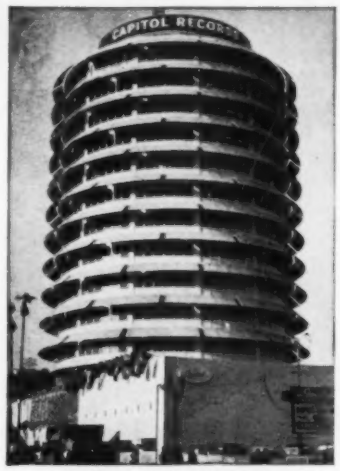
"DX-100" power assisted drive tool uses power assist behind drive piston instead of behind fastener. Unit designed for installations where threaded studs, drive pins, and drive ring fasteners are used in lengths to 4 in. Studs and pins used are chrome vanadium alloys, rust resistant and in tapered shape.

Crop Drying Fan . . .

. . . with electrically driven aerodynamic vane-axiai wheel—*Chicago Blower Corp., Farm Products Div., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

Vane axial crop drying fan has air moving capacities ranging from 1500 cfm at 4 in. water gage to 12,600 cfm at 0.5 in. SP. Blade diameters of 18 or 22 in. available; unit may be supplied with 3450 rpm motor with hp ranging from 1½ to 7½.

(*Continued on page 204*)



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

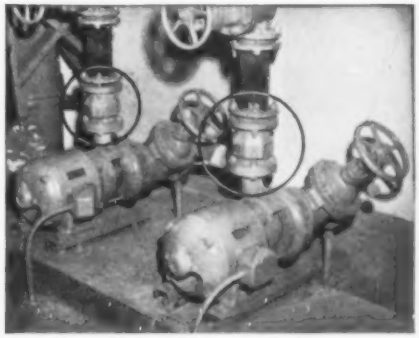
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



Write for literature • Agents in Principal Cities

MILLER VALVE CO., INC.

Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.

Keep heating costs low with HEV-E-OIL commercial-industrial burners

Hev-E-Oil burners furnish all the air necessary for combustion, assuring perfect fire control under all weather conditions. Low fire start that builds up gradually to the flame size required means smooth, safe operation. And once the burner is set for greatest efficiency, it *stays* that way no matter what the weather.

A complete package! Fire tested! Automatic, electronic controls. Meets all codes. Easy to install . . . Hev-E-Oil models from 5 to 150 gph. Also available, Hev-E-Duty power gas burners and combination gas/oil burners from 720,000 to 21,000,000 B.T.U.

For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-759.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

Quick selection from TACO's New LP Series gives you the Specific Centrifugal Pump you need to get Required Performance!

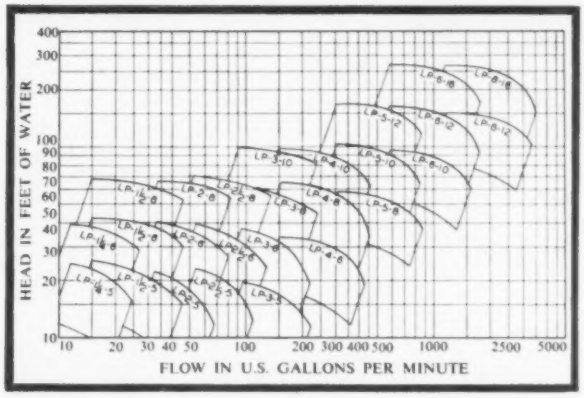
Now you can buy a centrifugal pump with almost the precise horsepower you need to get the pump performance you want! With exactness never before possible, the Taco LP centrifugal pump line design makes selection fast and easy.

For even further accuracy and economy you have these options!

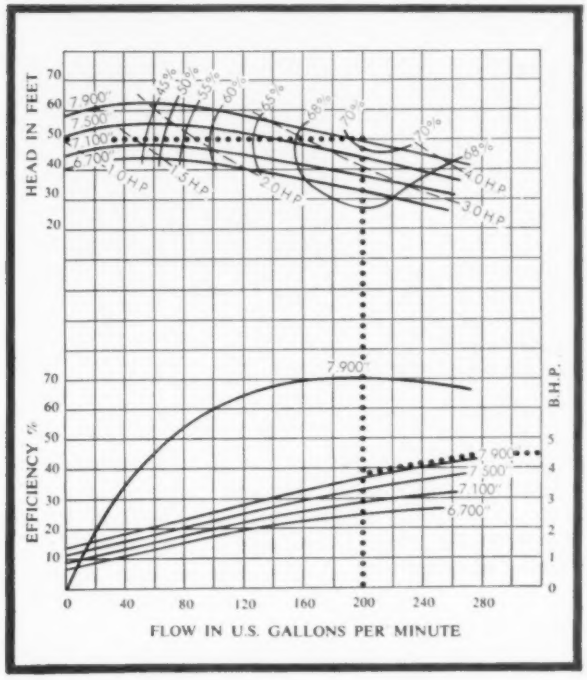
- Choose close-coupled or base-mounted models.
- Choose factory or field installation of water-cooling jackets.
- Choose sleeve or ball-bearing frames on base-mounted types.
- Choose mechanical seals or stuffing box.
- Choose the exact type of motor characteristics you want, including "extra-quiet".
- Choose stainless steel or carbon steel motor shafts, with or without stainless steel sleeves.

Fewest pump units for broadest performance range! Taco's carefully preplanned pump design has resulted in a minimum of centrifugal pump units to cover the broadest range of head and flow performances at optimum efficiencies!

Taco quick selection charts make it easy! Yes, this easy! Take a specific example where the requirement calls for pumping 200 GPM against a 50' head, with a design specification of a 1750 RPM motor. In seconds, Taco's 1750 RPM Quick Selection Chart below (3450 chart available, not illustrated) tells you that the Taco LP 3-8 is your pump.



Getting horsepower and efficiency data is just as easy! Just follow the dotted line on this LP 3-8 Performance Curve. Note that you'll need a 7.900" impeller, a 4.4 BHP (5 horsepower) motor and that efficiency will be 70%.



All Taco LP Pumps are tested and rated in accordance with the procedures of the Hydraulic Institute of which Taco is a member.

To cut inventory and maintenance costs LP pump parts are standardized! All LP's have ASA flanged connections; dynamically balanced impellers with double wear rings and rotatable center line discharge casings for automatic venting. Standardization of parts is welcome news to all cost conscious pump users.

New LP pump catalog, with quick selection charts available now! You will find this new catalog to be complete, extremely helpful. In addition to quick-selection charts and performance curves, it gives complete details about Taco LP's . . . the most flexible line of centrifugal pumps ever offered hydronic engineers! Write for your copy today!

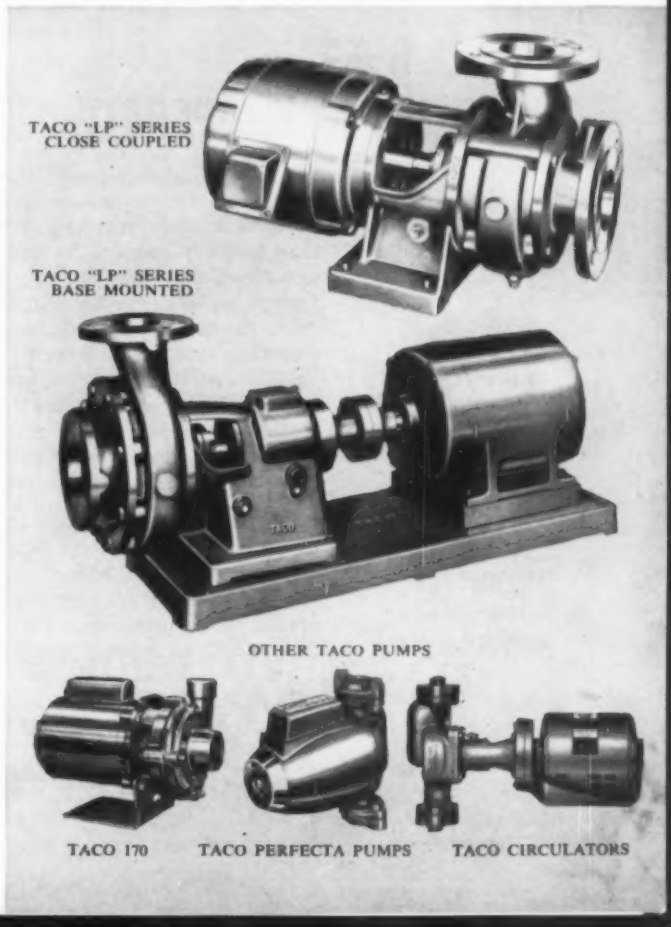
TACO

HEATERS INCORPORATED

1160 Cranston Street Cranston 9, Rhode Island

Taco®

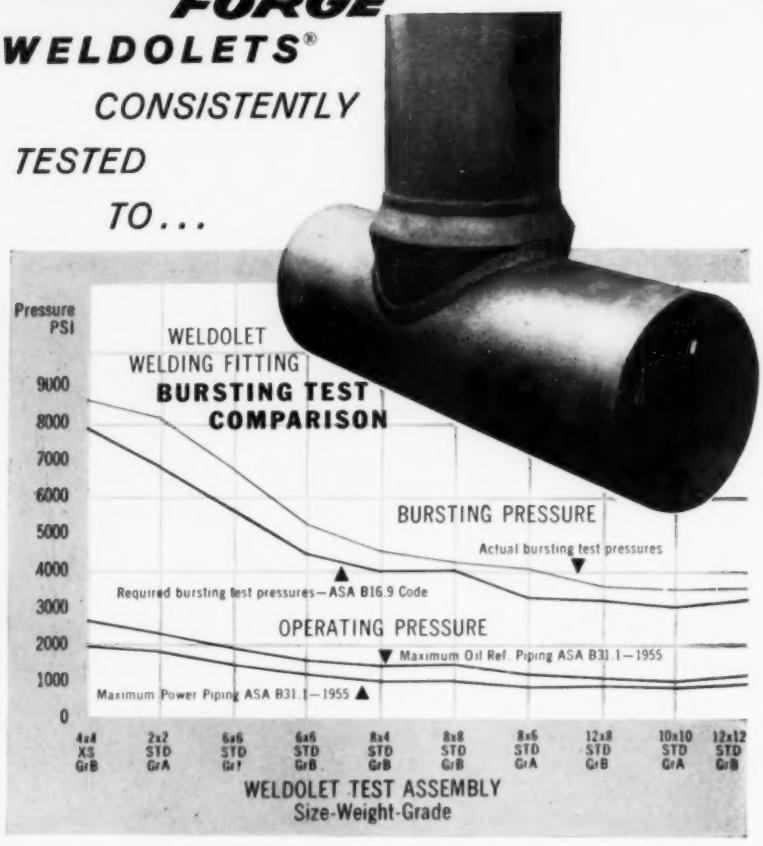
Serving the Hydronic Industry Since 1920



BONNEY FORGE

WELDOLETS®

CONSISTENTLY TESTED TO...



...OVER

4½ TIMES MAX. OPERATING PRESSURE

"Shape of Reinforcement"—has been pioneered by Bonney for the past 20 years. The fact that shape is as important and even more important than area replacement for branch reinforcement is now gaining wide industry recognition. Even though Weldolets *do* have sufficient area replacement, the factor setting them apart from conventional lap type reinforcement is their SHAPE . . . Reinforcement close to the juncture—completely bonded homogeneous reinforcement avoiding cracks, fillet welds, and re-entrant corners—reinforcement tapering at the sides to prevent abrupt change in thickness where fitting joins header pipe.

Recent design improvements in the Weldolet line, based on extensive stress analysis tests, provide all these desirable "shape" factors. Specify and use Weldolets for all your full size and reducing branch connections. They are available in carbon steel and all alloys for any piping service.

BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

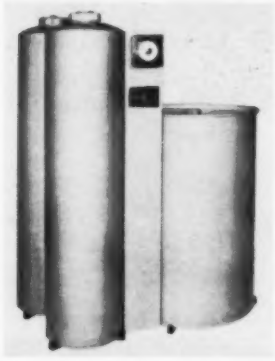
CARBON STEEL
STAINLESS
ALLOY
for all services

BONNEY FORGE and TOOL WORKS

ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS

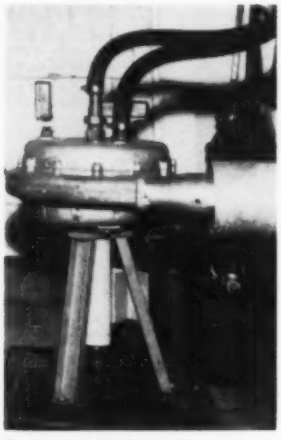
Continued from page 200



Water Conditioning Units

. . . designed to provide completely automatic soft-conditioned water—*Water Refining Co., Dept. HPAC, 104 Manhattan St., Middletown, Ohio.*

Line of company's "Miracle Water Conditioners" includes capacities ranging from 30 to 180 gpm based on 10 psi. Units can produce 10,800 gph of uninterrupted, completely refined and softened water, according to manufacturer. Rust, iron, turbidity removed as well.



Package "Boiler" . . .

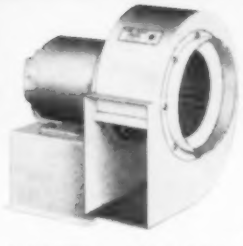
. . . capable of delivering continuous quantities of 100 psig steam within 15 seconds, starting with cold tap water—*Turb-O-Heat, Inc., Dept. HPAC, 1133 E. 35th St., Brooklyn.*

Steam generator is fin-and-tube heat exchanger section rotating at 3600 rpm within casing. Centrifugal force on fluid in tubes promotes rapid flow through tubes, resulting in rate of heat transfer of over 300,000 Btu per hr. Unit is 20 × 20 × 30 in. in size.

large or small...always specify BARRY for your air moving requirements!

Ready for shipment (below) are several BARRY 60" impeller diameter centrifugal fans—each capable of moving over 100,000 cfm.

BARRY
CENTRIFUGAL FANS



A BARRY centrifugal fan with a 6" impeller diameter takes little space, moves up to 500 cfm of air quietly and efficiently.

Whether your specifications call for centrifugal fans with an impeller diameter as large as 90", or as small as 6" . . . there's a BARRY blower that can meet your needs *exactly!* Regardless of size or capacity, every BARRY unit is precision engineered, expertly balanced, and carefully tested and inspected before shipment. Fans are available in all classes from I through IV – and you'll get fast delivery on every order! When you need centrifugal fan equipment with proven efficiency and dependability – *always* specify BARRY!

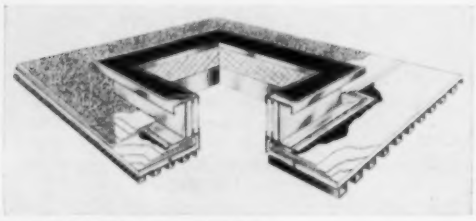
member of air moving and conditioning association inc.

BARRY BLOWER CO.
3100 CALIFORNIA ST. N. E., MINNEAPOLIS 18, MINN.

FC VENTILATING FANS • INDUCED DRAFT FANS • STEEL PLATE FANS • FAN WHEELS AND SCROLLS • BBC VENTILATION FANS • FORCED DRAFT FANS • FUME EXHAUST FANS • UTILITY EXHAUSTERS • BELTED VENTILATING SETS • MATERIAL HANDLING FANS • MEDIUM PRESSURE BLOWERS • SPECIAL APPLICATIONS

EQUIPMENT DEVELOPMENTS

Continued



Roof Ventilator Curbs . . .

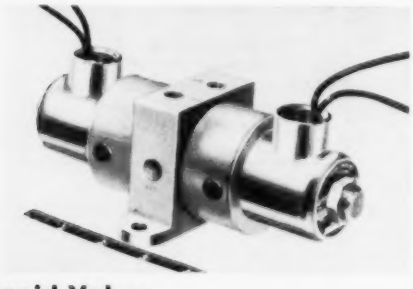
. . . of extruded aluminum, acoustically and thermally insulated—*Penn Ventilator Co., Inc., Dept. HPAC, Goodman St. and Allegheny Ave., Philadelphia* 40.

"Sonotrol" self-flashing curbs may be ordered as soon as necessary roof opening dimensions are determined for delivery when needed. Acoustical, thermal insulation helps absorb percentage of fan noise, reduces sound energy and reflections.

Corrosion Inhibitor . . .

. . . by application of sodium in combination with orthophosphate—*Climax Molybdenum Co., Div of American Metal Climax, Inc., Dept. HPAC,* 500 *Fifth Ave., New York* 36.

Sodium molybdate is non-toxic corrosion inhibitor. Recommended by manufacturer for application where toxic materials cannot be used. Also recommended for industrial applications such as cooling towers and jackets, recirculating hot water systems, boilers, air conditioning systems.



Solenoid Valve . . .

. . . in corrosionproof design with two internal moving parts and completely protected solenoid coils—*Airmatic Valve, Inc., Dept. HPAC,* 7317 *Associate Ave., Cleveland* 9.

Four-way solenoid valve has full 1/8 in. orifice (zero to 300 psi) to 3/16 in. orifice (zero to 90 psi), with no restriction on orifice sizes. Unit designed so media does not pass around solenoid plungers. Coils sealed from air, oil, gas, water, and are interchangeable for continuous or intermittent duty, a-c or d-c. Valve can be bottom drilled for manifolding or tapped for standard connection (1/8 or 1/4 in. NPT).

(*Continued on page* 210)

YOUR IDEAS WORK BETTER WHEN YOU WORK WITH HONEYWELL

THE FOLLOWING pages bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 sales offices throughout the country. Each is staffed with control specialists to assist you in writing specifications and preparing control layouts.

EXAMPLE: From Honeywell's c
exact pneumatic val

Single seated pneumatic valve

3-way pneumatic valve

This new line of Honeywell Pneumatic valves gives you superior performance characteristics, sharply upgraded ratings

BECAUSE valves supply the final control for over 90% of all temperature control systems, Honeywell has concentrated increasingly on the engineering of more dependable valves.

This newest line of Honeywell Pneumatic valves comes from four years of research, design and testing—an intensive development program which has produced a series of valves that set new industry standards for reliability and performance.

New valves provide wider limits of rangeability! These new valves provide accurate control of flow from the fully open position to the critical, hard-to-control light load situation. This has been made possible by these advanced design concepts:

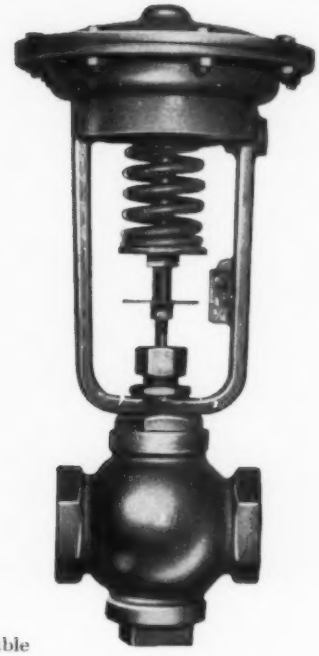
- A contoured plug or "characterized" V-port, precision made, provides a gradually-increasing rate of flow, giving far more sensitive fluid control.
- "Positive positioning"—made possible by the check-and-balance principle of the unique Honeywell Gradutrol relay. It assures accurate stem positioning regardless of changes in pressure differential.

They're designed for minimum maintenance. Precision design eliminates friction. Critical parts are made of durable, wear-resistant materials—Neoprene motor diaphragm, stainless steel stem, teflon packing, composition disc.

If repair is ever required, valve design permits fast, convenient parts replacement. For example, in most models the yoke can be removed to replace valve stem, packing, disc or seat without removing the valve from the line.

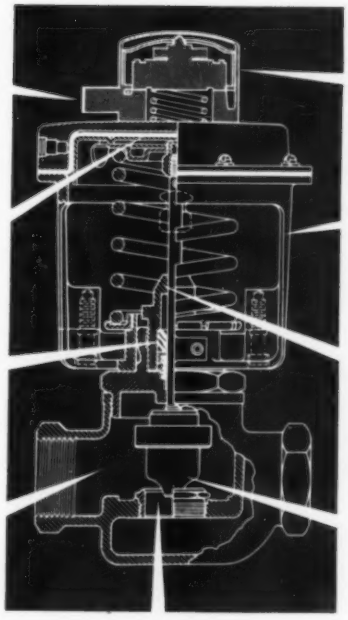
Honeywell Pneumatic valves are available in a wide variety of types and sizes—one to meet your exact requirement. Your Honeywell control specialist will supply you with complete specifications for the entire line, supply you with valuable assistance in choosing the valve to order. Call him at your local Honeywell office or write Honeywell, Dept. AC-7-107, Minneapolis 8, Minnesota.

complete line . . . the
alve to match your application



Series 400 double seated diaphragm valve

Series 400 single seated diaphragm valve



Air Connection Rotates 360° with Actuator.

Replaceable, Sensitive Roll Type Diaphragm.

Teflon Packings are Spring-Loaded and Self-Adjusting.

Large Flow Chamber Permits Higher Capacity.

Gradutrol Relay Insures Positive Positioning of Valve Stem.

2-Piece Yoke Simplifies Maintenance

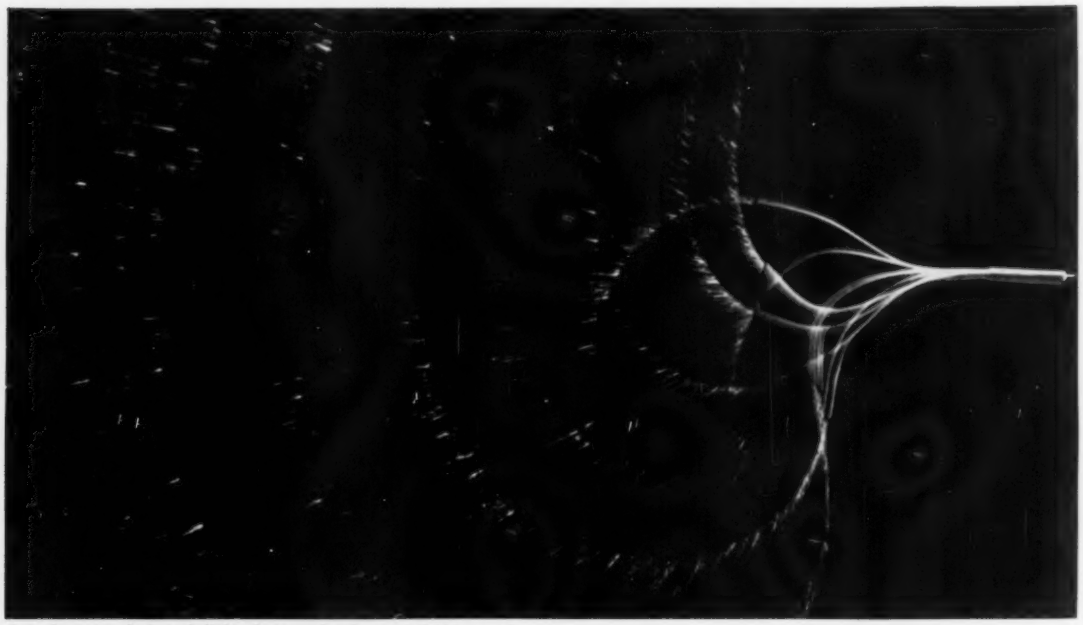
Sliding Stem Retainer for Simpler Installation

Contoured Plug Insures Equal Percentage Flow at All Load Levels.

Seat Can Be Replaced without Removing Valve From Line.

NOW! FLUTTER-JET WASHING

Another first for Honeywell's ELECTRONIC AIR CLEANER

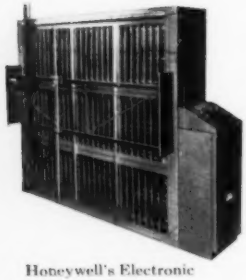


Actual unretouched strobelight photograph taken at 1/2,000 second.

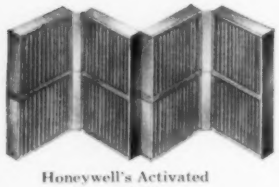
Never before such a quick, efficient way to wash electronic air cleaners! Honeywell's new flutter jet washer literally *blasts* water throughout the air cleaner, with a fluttering, sweeping action that flushes away accumulated dirt quickly—cleans every part thoroughly. The new flutter jet nozzle never clogs.

Honeywell's Electronic Air Cleaner

Removes 90% or more of all airborne dirt



Honeywell's Electronic Air Cleaner



Honeywell's Activated Charcoal Filter

You can now select from three types of cells: (1) *Hi Velocity*—for 90% or more dirt removal or where space is limited. (2) *Standard*—for normal conditions, provides high efficiency dirt removal and high dirt capacity. (3) *Hi Load* for handling high dirt concentration.

With these 3 different cell capacities, you can have complete freedom in designing your plenums. Just select the cell type and number of cells that will give you the air cleaning capacity you need in the plenum space available. No longer is it necessary to design your plenum to fit the air cleaner.

Remove Odors, Too

For the ultimate in air cleaning, team up Honeywell's Electronic Air Cleaner with the Activated Charcoal Filter—for removal of *all odors and gases*, too. Only Honeywell offers this *exclusive* combination.

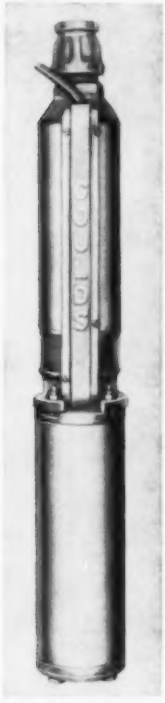
For more information about Honeywell air cleaning, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department AC-7-107, Minneapolis 8, Minn.

Honeywell

H HONEYWELL First in Control

EQUIPMENT DEVELOPMENTS

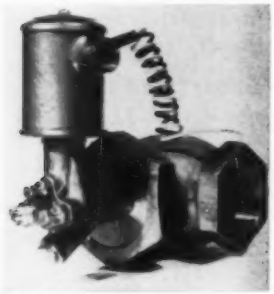
Continued from page 206



Submersible Pump . . .

. . .with corrosion resistant parts—*Goulds Pumps, Inc., Dept. HPAC, 50 Black Brook Rd., Seneca Falls, N. Y.*

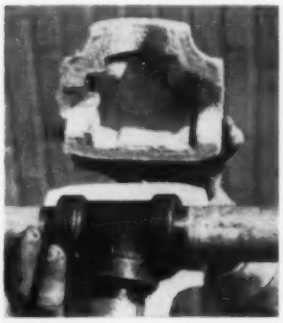
"Silent Flow" pump said to be highly resistant to corrosion and abrasion. Has plastic impellers, guide vanes, cover plates, with stainless steel bowls and hex shaft. Pump can be used with any NEMA standard motor. Available for 4 in. and larger wells in 1/3, ½, ¾ hp for well depths to 280 ft and capacities to 870 gph.



Solenoid Valves . . .

. . .for general service applications — *J. D. Gould Co., Dept. HPAC, 4707 Massachusetts Ave., Indianapolis* 18.

"Type HV" and "Type HV-P" solenoid valves have four independent controls for adjustment of opening, closing speeds, flow control, and for manual operation in case of power failure. Features cited: built-in filter in control head; interior passages provide high flow conditions.



Pipe-Fitting Insulators . . .

. . .installed by placing two halves of insulator over pipe fitting, and stapling, wiring, or taping sections together — *Insul-Coustic Corp., Dept. HPAC, 42-23 54th Rd., Maspeth 78, N. Y.*

"Insul-Sure" fitting insulators said to be immune to rust, rot, and corrosion. Sizes available: 1 in. thick for ½ to 8 in. screwed fittings or 2 to 8 in. welded fittings; 1½ in. thick for ¾ to 8 in. screwed fittings or 2 to 12 in. welded fittings. Insulators are easily removed, replaced. Operating temperatures up to 450 F.

Oil Interceptor System . . .

. . .designed to solve many oil interceptor and disposal problems — *Josam Mfg. Co., Dept. HPAC, Corymbo Rd., Michigan City, Ind.*

"Series GH" oil interceptor designed for applications reclaiming oils. Features cited include: oil removed from waste effluent automatically; separated oil emerges in reusable clean or clarified state; oil drawn into portable container; sediment intercepted, separated for removal.

Inert Gas Welder . . .

. . . in package unit for remote, tungsten-intert-gas shielded arc welding —*Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy* 1, *Ohio.*

Portable "Tigpak" welding unit designed to eliminate need for moving arc welding equipment and extending water lines for remote welding jobs. Unit has a-c/a-c gasoline engine driven welders of 200 or 300 amp capacity. Can be used with d-c gas driven welders provided source of 110 volt a-c power is available; also with electric powered d-c, a-c or a-c/d-c motor-generator sets.

Break Glass Switches . . .

. . .rated at 5 amp, 250 volts a-c, or 10 amp, 125 volts a-c—*Automatic Switch Co., Dept. HPAC, Florham Park, N. J.*

Two forms of control switches available. First, mechanically held remote control is single pole, double-throw switch. Remote control switch opens when glass is broken. Control switch cannot be electrically reclosed until glass is replaced. Second type suitable for two wire operated devices such as motor starters or solenoid valves. Single pole, single-throw switch. Glass of switch holds switch in closed contact position. When glass is broken, switch contacts open.

Water Hammer Eliminator

. . . designed to provide efficient method of controlling hydrostatic shock and eliminating water hammer on hot or cold water piping systems —*Jay R. Smith Mfg. Co., Dept. HPAC, 1119 Morris Ave., Union, N. J.*

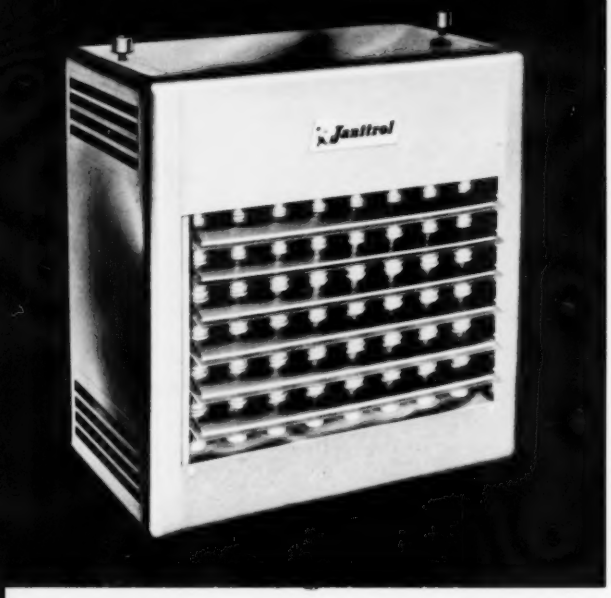
As shock occurs, stainless steel bellows of "Hydro-Trol" expand into pressurized expansion chamber which provides displacement required to absorb and control shock. Bellows surrounded by hydraulic

(Continued on page 214)

Sell and Grow with

JANITROL

provide fast, clean heat for a variety of applications



Sell and Grow with JANITROL

Gas-fired Commercial and Industrial Heating Equipment

VERSATILE NEW JANITROL UNIT HEATERS

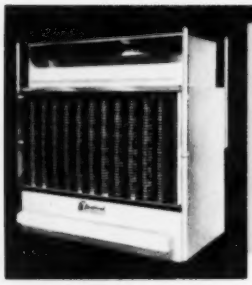
Remember this about Janitrol Unit Heaters: their versatility and efficiency, combined with low cost, means you can use them to advantage for most every commercial or industrial building.

They save installation time and labor. They do not need expensive duct work. They are completely automatic. They offer convenient "dual fuel" performance—use natural or LP gas; may be switched from one fuel to the other automatically. And they direct heat *where* needed only *when* it is needed—assure top operating economy.

And remember, too, that no other unit heater can match their record for durability and low maintenance. The exclusive Janitrol Multi-Thermex heat exchanger is so enduring that replacements for any cause have been less than ¼ of 1% in over two million heat exchanger tubes produced since 1940!

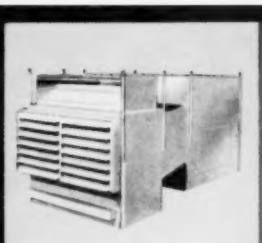
Dependability and economy—these are benefits that only time and experience can bring. Be sure Janitrol Unit Heaters are the choice for your next job.

Fill every commercial and industrial heating need from JANITROL'S broad line . . .



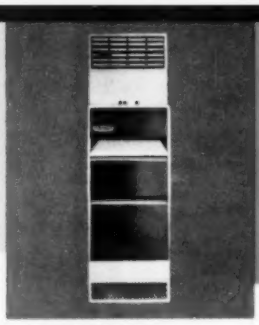
GAS-FIRED DUCT FURNACES

Engineered for installation in a duct where air is circulated by a separate blower. Especially adaptable for use in combination with cooling. Two sizes: 200,000 and 300,000 Btu/hr. input—may be combined to provide capacity from 200,000 Btu/hr. up, in increments of 100,000 Btu/hr. input. Five sizes, from 85,000 to 225,000 Btu/hr. in Duct 55 models.



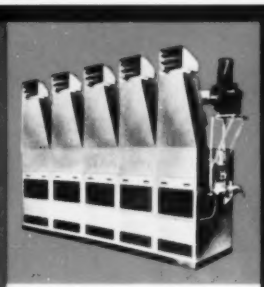
BLOWER-TYPE UNIT HEATER

Allows air delivery from greater heights and against greater static pressures. Models with exposed or enclosed blowers. A.G.A. approved as low and high static-type blower unit heater for air delivery to duct system up to 1.0 in. W.C. external static. Heat sections factory assembled. Sizes: 300,000, 400,000 and 500,000 Btu/hr. input.



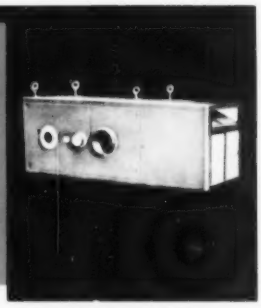
FLOOR-TYPE UNIT HEATER

Cold air drawn from floor level is heated, filtered and discharged horizontally overhead. Quiet, clean, carefree—ideal for offices, restaurants, stores, labs, etc., requiring a compact unit. May also be connected to a duct system. Six sizes: Rated input from 65,000 to 200,000 Btu/hr.



HEAVY DUTY BLOWER HEATERS

For unit heating, central heating and air conditioning. Wide range of standard blowers and motors assures correct air delivery and temperature rise in each application. Factory assembled and tested. Capacities from 250,000 Btu to 1,750,000 Btu/hr. input.



NEW JANITROL HORIZONTAL OIL UNIT HEATER

For suspension overhead. Saves floor space. Compact, efficient, low-maintenance design. May also be used to feed duct system. Sizes from 84,000 to 250,000 Btu/hr. output.

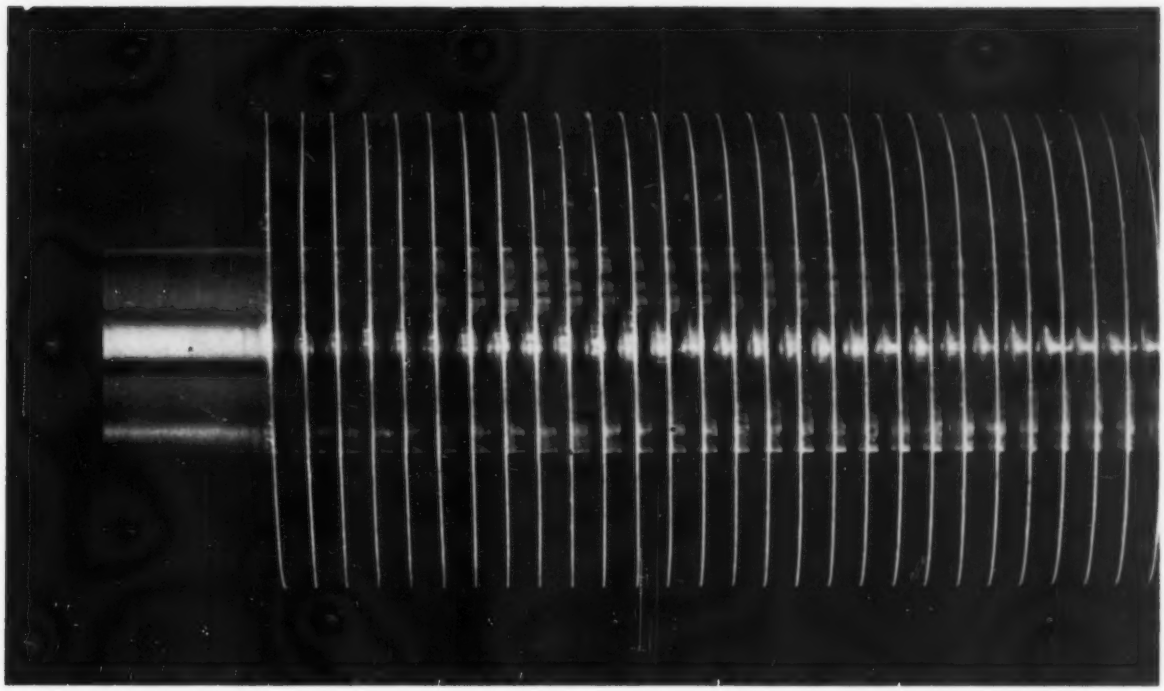
ARCHITECTS, ENGINEERS AND CONTRACTORS *information service*

Write today for complete information on heating with gas in buildings of every type. There's no obligation.

JANITROL®

HEATING AND AIR CONDITIONING DIVISION
Surface Combustion Corporation, Columbus 16, Ohio
In Canada: Moffat Heating & Air Conditioning Division
Moffats, Ltd., Toronto, 15

Also Makers of Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment



AEROFIN
Smooth-Fin Coils offer you

Greater Heat Transfer
per sq. ft. of face area

Lower Airway Resistance
—less power per c.f.m.

Aerofin smooth fins can be spaced as closely as 14 per inch with low air friction. Consequently, the heat-exchange capacity per square foot of face area is extremely high, and the use of high air velocities entirely practical. Tapered fin construction provides ample tube-contact surface so that the entire fin becomes effective transfer surface. Standardized encased units arranged for simple, quick, economical installation.

Write for Bulletin S-55

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

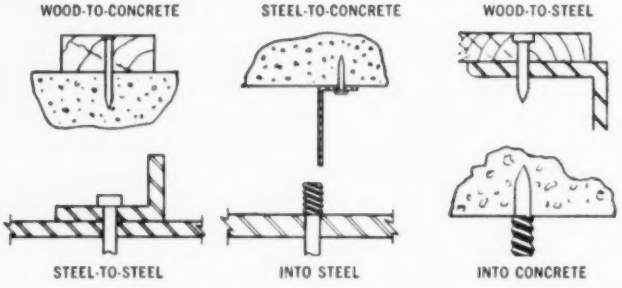
Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ONLY RAMSET

"covers all the bases in powder-actuated fastening"

This statement has been made by hundreds of contractors, architects, electricians, plumbers, maintenance men, supervisors, foremen and others over the past ten years! Whatever the job, if it involves fastening into concrete or steel Ramset can do it more easily, efficiently, and with a lower in-place fastener cost.

Threaded studs, drive pins, eye pins—over 100 specialized fasteners team with ten types of powder charges to assure you of just the right holding power for each job. It will pay you to get more details. Your Ramset dealer is listed in the Yellow Pages under tools . . . call him today!



In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set® hammer-in tools for light fastening, and Ringblaster® heavy-duty kiln gun.

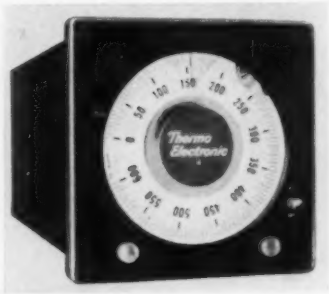
Ramset® Fastening System

WINCHESTER-WESTERN DIV. • OLIN MATHIESON CHEMICAL CORPORATION
12109-G BEREA ROAD • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

Continued from page 210

fluid which, under shock pressure, forms hydraulic pressure cushion that holds bellows in alignment and prevents shock waves from bouncing, stabilizing water in line. Unit available in six sizes.



Signaling Controller . . .

. . . developed to provide accurate, automatic control of industrial operations suitable for two position control action—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N.J.*

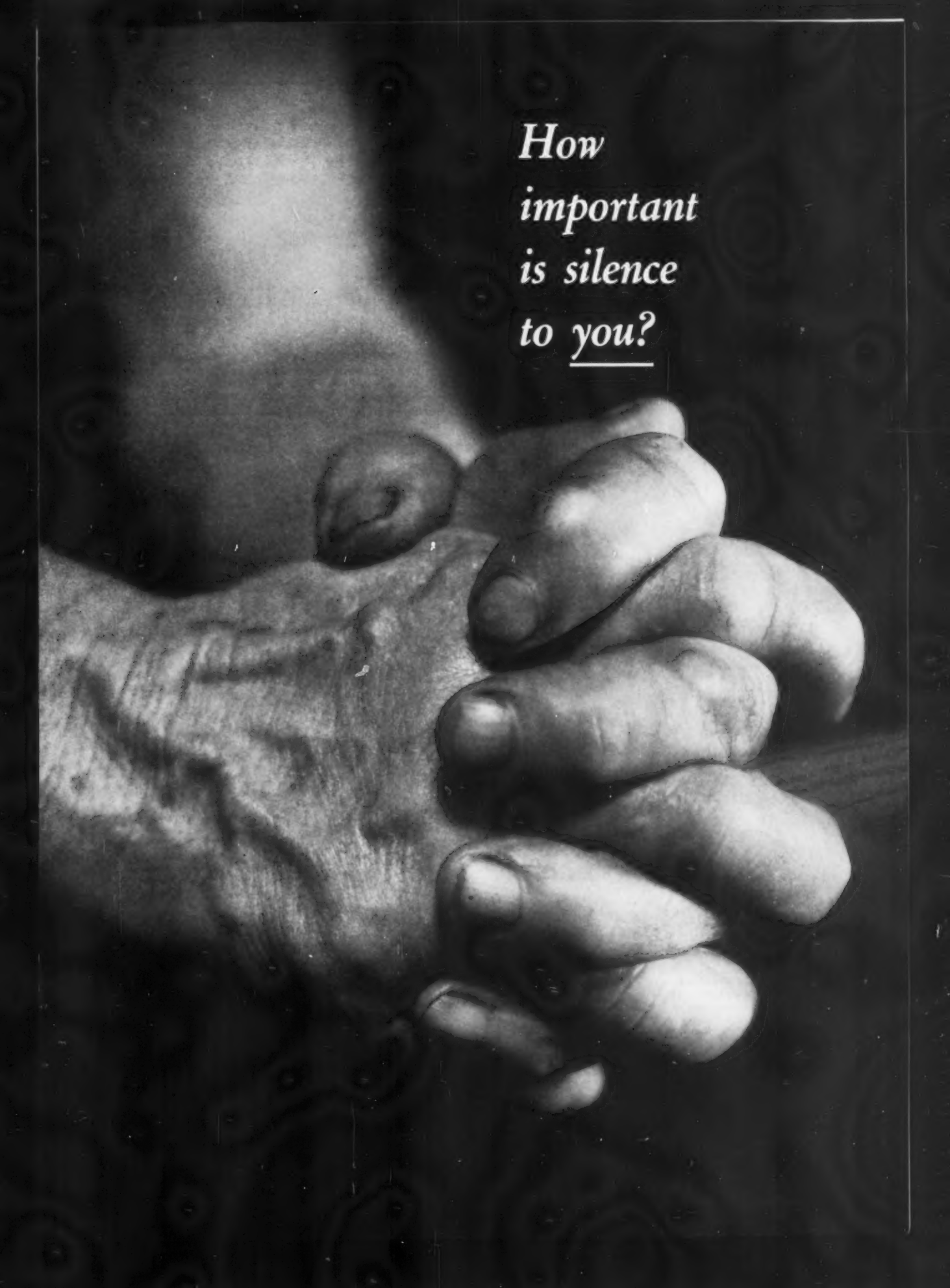
Controller can be used with any transducer generating d-c signal, such as thermo-couples, tachometer generators, etc. Reacts to change of 1 microvolt. Calibration accuracy said to be within ±0.25 percent of full scale span or 5 microvolts. Ranges available from 1 to 100 microvolts. Built-in safety control action causes control relay to shut off process heat when failure of any system component occurs.

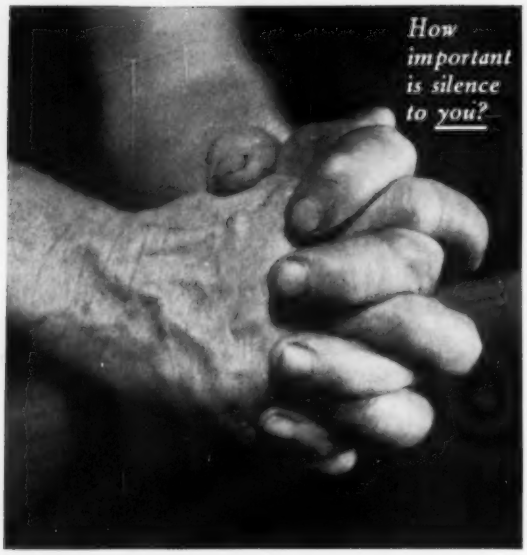
Surface Coatings . . .

. . . available in variety of formulas —*Coroshield Co., Ltd., Dept. HPAC, 250 W. 57th St., New York 19.*

Surface coatings developed to give inorganic, impervious, micro-thin films resistant to fire, chipping, peeling, flaking, abrasion. Coatings prevent oxidation of hydrochloric, nitric, sulphuric acids. Available in liquid form. May be applied to organic and inorganic materials, ferrous and nonferrous metals, synthetic and substitute materials. Coatings withstand constant temperatures of 400 F, occasional sudden increases to 1100 F.

(*Continued on page 218*)


How
important
is silence
to you?

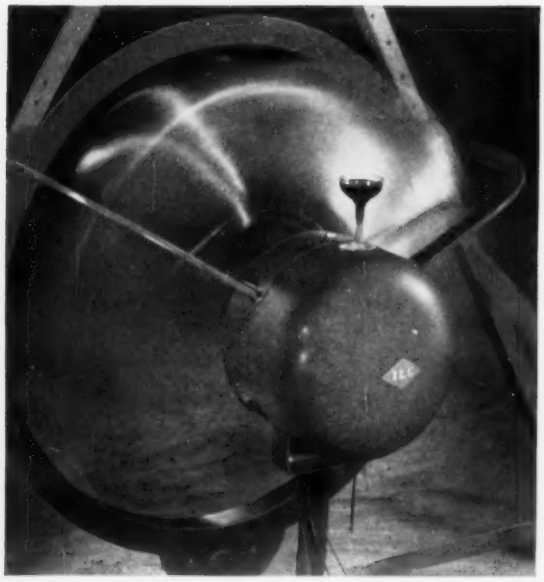


when it's silent operation . . .

You know how important silence is in church . . . how out of place, how nerve-wracking noisy equipment can be.

So do consulting engineers . . . and the more than 500 churches that have recently put in Ilg fans and ventilators. They know that Ilg-built equipment always operates

Here's why ILG *fans and assure silent service,*



Not a Bubble in the Burgundy—due to vibration, that is. This 42" direct-connected, dynamically balanced, self-cooled Ilg propeller fan—turning at full speed—is so vibration-free that you have to look *below* the surface of the sparkling burgundy to spot any motion whatsoever.

Silent Centrifugal Performance starts with these backward curved (BC) blades and *airfoil* design that eliminate eddy currents and turbulence. Other "silencers" are: Ilg's smooth contour air intake; Ilg-built motors and direct-connected fan wheels. No belts or pulleys. Sized for operations to 9" static pressure.

For fans built to satisfy your "specs"...

Each ILG product shown carries the rating seal of the Air Moving and Conditioning Association, Inc.

510 churches thank ILG for electric ventilating equipment

quietly . . . economically . . . and for a *long, long time.*

Some of the reasons why Ilg ventilating equipment steadily gains in popularity are shown below. And regardless of the *size* or *type* of Ilg-built products you choose, you can count on complete satisfaction from an *operating cost* standpoint . . . from a *performance* standpoint . . . and from a *length-of-service* standpoint.

For further details on the complete line of Ilg electric ventilating equipment, send for Catalog No. 159 on propeller fans, Bulletin No. 257 on *airfoil* centrifugals, Bulletin Nos. 2302 and 2701 on power roof ventilators.

ILG *power roof ventilators*

vibration-free performance

Points to Your Profit. He's pointing out that Ilg *self-cooled* motor and *patented** pressure-type cooling of separate motor compartment eliminate heat build-up of *any* type. Also worth pointing out: Ilg backward curved (BC) blades and *airfoil* design for smooth, quiet air flow and low shock loss.

*Patent No. 2711682

Name Your Size. Ilg propeller fan power roof ventilators give you a choice of capacities. 11 different sizes for exhausting as little as 87 c.f.m. to 21,100 c.f.m. Under this low-height housing operate a vibration-free, direct-connected, Ilg-built motor and patented "Q" type fan wheel.

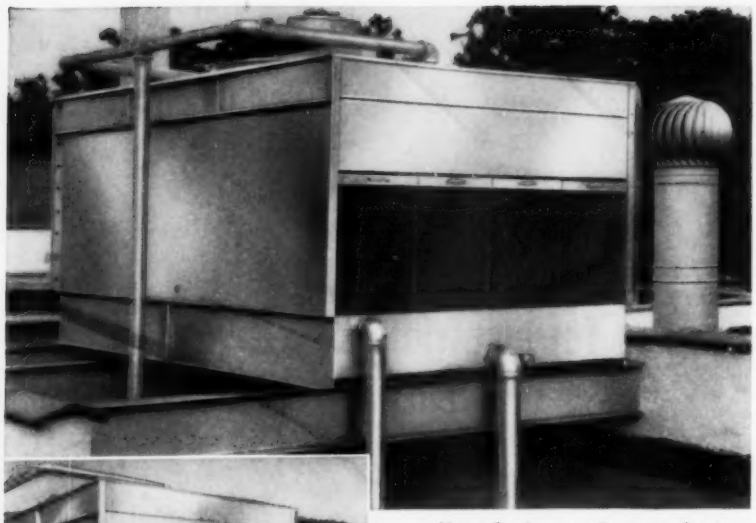
specify ILG

ILG ELECTRIC VENTILATING COMPANY

2826 N. Pulaski Road, Chicago 41, Illinois

Offices in 57 Principal Cities

Member of Air Moving and Conditioning Association, Inc. (AMCA)



Above: Condenser cooling water, for steam treating equipment used in milk-flavor control, is dropped from 100° F to 80° F in this 50-ton Binks Watertemp cooling tower.

Left: Plastic decking packages slide out for easy cleaning maintenance.

AT BORNHOFF DAIRY...

New cooling tower design makes maintenance easy

"In a dairy, all processing equipment must be spotlessly maintained," reports Mr. Harvey Bornhoff, partner of Bornhoff Dairy, Inc., Glenview, Illinois. "That is why we like our Binks Watertemp cooling tower. In addition to doing an efficient job of cooling condenser water under all weather conditions, the tower is a snap to maintain and clean."

No spray nozzles to clean

"Water just comes in at the top of the tower. It spreads out over a distribution pan, that has holes in it, and starts down through the tower."

Slide-out plastic decking

"The multi-finned plastic decking slides right out of the tower in easy to handle packages. Hosing down and clean-up can be thorough. With decking out, we also have complete inside access to the tower."

Needs no paint

"We won't have to paint the tower either. All parts were hot-dipped galvanized after fabrication to make them completely weatherproof."

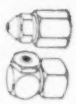
Free specification details

Send for Bulletin WT 501. Contains the details you need to specify big tower performance that has low bid potential. Get a copy from your nearest Binks Branch Office or write direct.

9327

Binks

EVERYTHING FOR WATER COOLING



A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company

3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

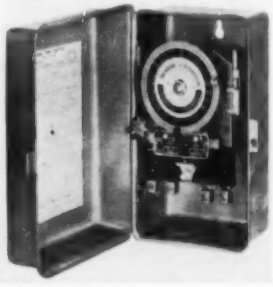
EQUIPMENT DEVELOPMENTS

Continued

Pressure Control . . .

. . . designed for air, gas, or liquid applications—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

"Type J6 Model 200" waterproof pressure control designed for applications requiring close on-off differentials. Adjustable ranges are from 30 in. Hg to 300 psi with differentials from 1.5 ± ½ in. Hg to 4 ± 1 psi. Control is uncalibrated and pressure settings made by accessible hexhead adjustment screw. Switches available include normally open, normally closed, or double throw with no neutral position. Rated for 15 and 20 amp at 115/230 volts a-c. All switches are single pole and suitable for ambient temperatures to 180 F.



Time Switch . . .

. . . designed for versatile automatic heating control—*Tork Time Controls, Inc., Heating Control Div., Dept. HPAC, 33 Grove St., Mt. Vernon, N. Y.*

In addition to normal switching from high to low thermostat, "Tork 1197NB" time switch provides automatic "fast morning pickup." Switching calls for: night setback; morning pickup; standard day operation. Omitting device permits elimination of heating on specified days, without altering master daily cycle.

Gas Heating Controls . . .

. . . including diaphragm gas valves, automatic pilots, regulators — *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

"Series 9100" and "Series 9200" diaphragm gas valves supplied in

Norman Classroom-Packaged System

HEATS AND VENTILATES
with TRIPLE Economy

MARY G. HOGSETT SCHOOL
DANVILLE, KENTUCKY

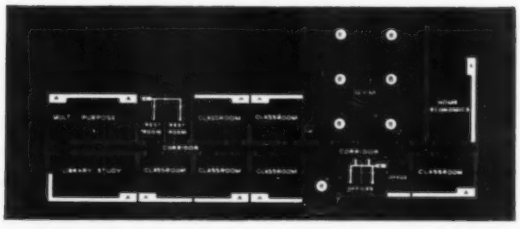
Building Gross Area: **17,000 Square Feet**

Total Building Cost: **$10.54 per Square Foot**

Heating and Ventilating Cost: **.876 per Square Foot**

ARCHITECT: Merriwether, Marye & Associates
Lexington, Kentucky

FITS ANY PLAN



Versatile Norman Schoolroom Heating and Ventilating Systems answer the needs of classrooms large or small. 85,000 or 100,000 BTU/hr inputs are available. Util-i-Duct Bookshelf Sections add work surface and storage space; then Wall-i-Duct Sections save room space.

ECONOMY OF INSTALLATION

Pre-wired, partially assembled Norman Heating and Ventilating Systems are quickly installed room by room. In new schools, like the Mary G. Hogsett school, Norman Systems eliminate expensive boiler rooms, chimneys and tunnels. The $0.876 figure is typical of the low installation costs being realized across the nation. Norman economy grows with the school . . . individual classroom systems are added as required without costly revamping of central system.

ECONOMY OF OPERATION

Norman Schoolroom Heating and Ventilating System:

- Maintains uniform temperature without wasting fuel
- Supplies heat only when needed . . . ventilates automatically
- Each classroom's comfort needs are answered accurately, independently of other rooms.

ECONOMY OF MAINTENANCE

Long trouble-free service is assured by sturdy construction, finest materials and latest A.G.A. approved controls — standard to the industry.

Norman®
PRODUCTS COMPANY

NORMAN PRODUCTS CO.
1156 Chesapeake Ave., Columbus 12, Ohio
We want to learn more about Norman Products for School Comfort. Please send complete information to:

NAME_____

COMPANY NAME_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

See Sweet's Arch. File 30h/No, American Sch. and Univ. Annual C-1/No

NOW —

Comfortably Cool in Summer

Coolair Fans did the job

This Fafnir Bearing plant in Newington, Conn., is an excellent example of how Coolair ventilating fans can make summer working conditions comfortable. They also keep the atmosphere free from fumes and smoke all year long.

Of importance to management is the fact that Coolair ventilating systems are installed in two weeks or less — in either new or existing buildings. And Coolair equipment is economical to operate — no water, no ducts. For complete information, write for Handbook on Commercial and Industrial Breeze Conditioning Systems. Sales offices in all principal cities.

American Coolair Corporation
P. O. Box 2300, Jacksonville 3, Florida

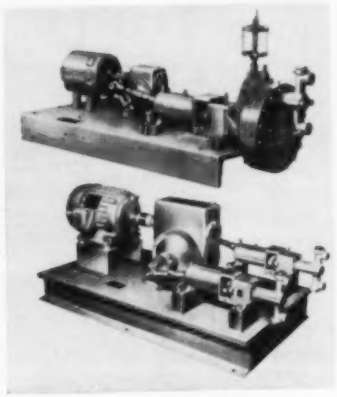
SEE OUR CATALOG IN SWEET'S
INDUSTRIAL CONSTRUCTION FILE

Charter Member Air Moving and Conditioning Association, Inc.

EQUIPMENT DEVELOPMENTS

Continued

sizes from ½ through 3 in. Combination diaphragm gas valves, automatic pilots and regulators available in ½ in. small, ½ in. large and ¾ in. sizes. May be supplied with manual opening, electric reset, 100 percent shutoff in all sizes.



Pumps . . .

. . .for laboratory and industrial services—*Clark-Cooper Co., Inc., Dept. HPAC, 300 Market St., Palmyra, N. J.*

"CC" line of pumps includes both plunger-type and diaphragm-type metering pumps. Both operate on reciprocating action of positive displacement plunger. Diaphragm pump has hydraulically balanced plastic diaphragm between plunger and pumped liquid. Design permits conversion from one type of pump to other by substitution of liquid end assemblies. Standard models range in capacity from one drop every 13 strokes to 1000 gph at discharge pressures to 10,000 psi. Flow output for each pump size is adjustable from zero to 100 percent capacity.

Pressure Control . . .

. . . intended for air, gas, or liquid pressures in hazardous locations where explosive gases or vapors are present—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown, Mass.*

Pressure ranges of "Type H98" pressure control are from 10 to 1700 psi, with a maximum pressure of

First Security practices security by specifying **steel pipe.**

galvanized **steel pipe** fills a tall order

Dependable, economical, galvanized *steel pipe* is used for the drainage and vent lines in the new First Security Bank Building in downtown Salt Lake City. But for that matter it might be almost any other large building in Utah or in any other place in America. Because architects, engineers and contractors through the years have learned that they can depend on *steel pipe* for a lifetime of service wherever major construction is going up.

Generations of experience have shown engineers and contractors that low-cost *steel pipe* goes in easily and economically—provides lasting performance in soil, waste and vent lines. It's another example of the many kinds of jobs that *steel pipe* can do best.

STEEL PIPE IS FIRST CHOICE

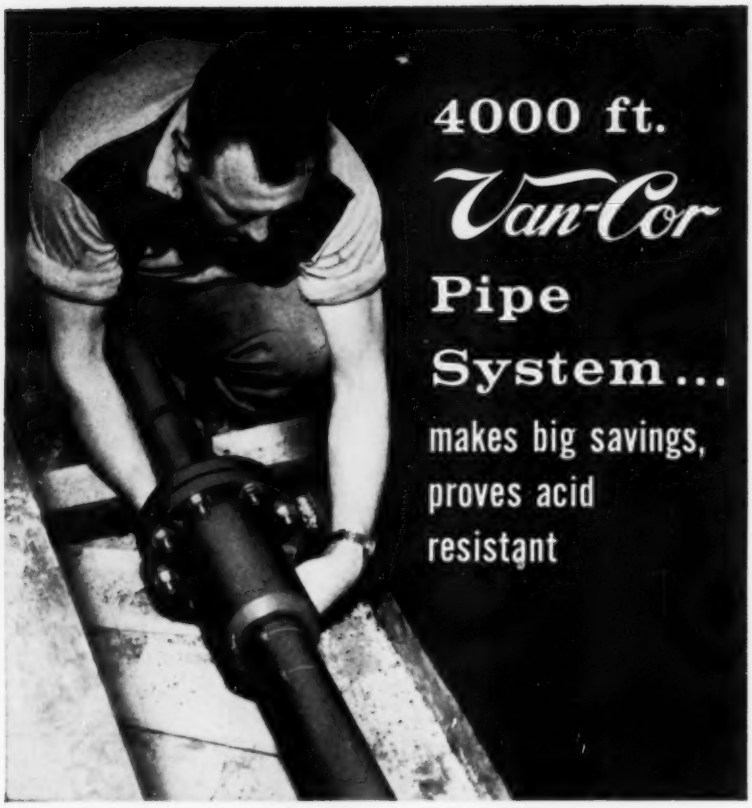
- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

150 East Forty-Second Street, New York 17, N.Y.



At the Allentown (Pa.) Works of the Western Electric Co., the entire waste acid disposal system in the recent addition consists of Van-Cor rigid PVC pipe and fittings.

HOW COSTS WERE CUT. Initial price of Van-Cor was ⅓ that of comparable cast iron alloy pipe. On a 6" line, labor costs were estimated at 29¢ per foot of run—about half that of metallic pipe. Also, because Van-Cor has only 1/10 the weight, no mechanized handling equipment was needed. Available in 10 or 20 ft. lengths, Van-Cor requires fewer joints, and eliminates the breakage problem.

CORROSION LICKED. Van-Cor pipe was used because "corrosion resistant" cast metallic pipe had performed short of expectations in an adjacent building. After 1½ years service, the Van-Cor system is in excellent shape, unaffected by such acids as hydrofluoric, hydrochloric, sulphuric, nitric and many plating solutions.

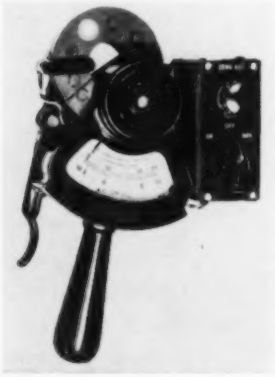
Investigate Van-Cor Pipe, Fittings, Valves, Electrical Conduit, and Fabrications . . .

Write for Catalog and Name of Nearest Distributor

INDUSTRIAL DIVISION OF . . .
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

EQUIPMENT DEVELOPMENTS
Continued

3500 psi. Instrument is calibrated, waterproof, explosionproof. Switch types available include: normally open, normally closed, or double-throw with no neutral position. Rated at 115/230 volts a-c. All switches single-pole and suitable for ambient temperatures up to 180 F.



Tong Ammeter . . .

. . . designed for measuring small amounts of direct current, in ½ amp divisions, from zero to 10 amp — *Columbia Electric Mfg. Co., Dept. HPAC, 4519 Hamilton Ave., Cleveland 14.*

"Type PB" ammeter takes measurements by clamping tongs around electrical conductor without breaking circuit or insulation. Jaws accommodate conductors to ½ in. diam. Two ranges provided on one dial: 10-zero-10 amp for d-c only; zero to 20 amp for both a-c and d-c.

Electrode Holder . . .

. . . with pistol grip containing built-in safety cut-out to prevent accidental "flashes" or shocks — *Frank Niemi Products, Inc., Dept. HPAC, Gurnee, Ill.*

VIBRATION & NOISE CONTROL NEWS

FROM THE APPLICATION ENGINEERING DEPARTMENT OF THE KORFUND COMPANY, INC.

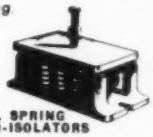
"Complete Package" Vibration and Noise Control

For years, air conditioning engineers and contractors have recognized Korfund Vibro-Isolators as the one sure means of stopping noise and vibration transmission through floors and structure.

Add Korfund Vibro-Hangers for suspending piping or equipment, and Flex-Hose for flexible piping connections and you have the whole vibration and noise control package.

Backed by a great name, with more than a half-century of experience in licking tough vibration problems, Korfund's three-way control package comprises a complete range of types and designs to meet any requirement.

Basic types of Korfund's vibration and noise control units are pictured below. For complete specifications write for Bulletin 68; you'll find it worth having.



STEEL SPRING VIBRO-ISOLATORS

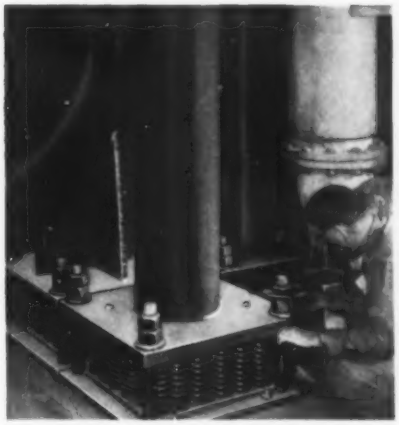
HANGERS

FLEX-HOSE—Metal or rubber.

30 STORY AIR CONDITIONING SYSTEM FLOATS ON SPRINGS FOR TOPS IN TENANT COMFORT

Tenant comfort was the chief aim when the Philadelphia Fidelity Trust Building, Philadelphia, Pa. decided to install complete summer-winter air conditioning. Providing correct temperature control throughout the 30 story building was one big consideration; another was to make certain that noise and vibration from mechanical equipment and piping would not disturb users of the office areas.

Working with consulting engineer Charles S. Leopold, Korfund engineers mounted pumps, compressors and other main conditioning equipment on steel spring isolators. Risers to the cooling towers offered a special problem. Transmission of vibration from the big pipes had to be prevented, and proper allowance had to be made for expansion and contraction without setting up stresses in the system. Specially designed Korfund spring mounts, supporting each of the risers at the bottom only, provided the answer. Together with the standard spring mounts used under the mechanical equipment, noise and vibration transmission was eliminated, insuring tenant comfort.



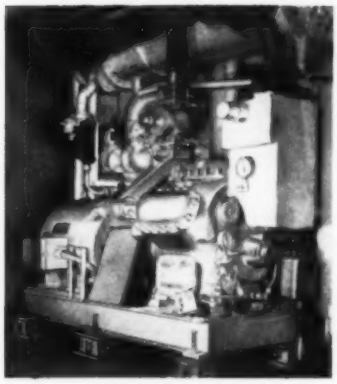
Four risers extending 29 stories to cooling tower, are supported by spring mounts. Filled weight 500,000 lbs.

Vibro-Hangers Put Gag on Talking Pipes at Chrysler

Photo shows some of the steel spring Vibro-Hangers used to prevent "talking" pipes in Chrysler Corporation's Kokomo, Indiana, plant. Resilient hangers prevent transmission of noise and vibration through ceilings into building structure, insure quiet in the office area overhead.

Units are part of the "complete package" of vibration and noise control engineered by Korfund. Included in the installation are vibration and noise isolation bases for fans and motors.

Vibration Control Increases Ship's Useable Living Quarters



Korfund isolators are used to mount five compressors and pumps on the S.S. Brasil and S.S. Argentina. Korfund Flex-Hose stops noise and vibration transmission thru piping.

Sister ships, S.S. Brasil and S.S. Argentina, have been called the "Last word in luxury afloat." However, their refrigeration system transmitted vibration and noise through the steel decking, making it virtually impossible to occupy living quarters near the installation.

Korfund engineers quickly saw that piping as well as compressors and pumps were the cause of the trouble, and recommended *two-way* vibration and noise control. Steel spring mounts were used beneath the equipment, metal Flex-Hose stopped transmission through the piping.

Whether for "luxury afloat" — or for critical commercial or industrial installations, Korfund's "complete package" provides the effective, economical solution to vibration and noise problems.

FOR MORE DATA OR SPECIFIC RECOMMENDATIONS WRITE TO KORFUND FOR BULLETIN #68

KORFUND

THE KORFUND COMPANY INC.

48-01F Thirty Second Place • Long Island City 1, New York

Over half a century of VIBRATION • SHOCK • NOISE / CONTROL & MEASUREMENT

Vibration & Shock Isolators • Flexible Connectors • Vibration Instruments • Acoustical Products

NEW dry acid compounds are measured, mixed with water for use. These cleaners are non-fuming, produce no corrosive gases... dry or in solution.

OLD-type liquid cleaners require special handling precautions. Fumes are a nuisance to personnel, can cause damage to electrical and other equipment.

✓No Hazardous Fumes

Just one of the reasons why **Dry Acid Cleaners** based on **Du Pont Sulfamic Acid** are gaining wide favor for industrial equipment cleaning: ✓ Safer to handle ✓ Easy to use ✓ No hazardous fumes ✓ Powerful descaling action ✓ Less corrosive ✓ Lower handling and shipping costs.

CLEANERS BASED ON SULFAMIC ACID REMOVE SCALE AND DEPOSITS FROM:
Air-Conditioning Cooling Towers, Ice-Making Machines, Evaporating Condensers.

DU PONT **Sulfamic Acid**

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

Please send me:

☐ Free booklet about dry-acid cleaners based on Du Pont Sulfamic Acid

☐ Names of formulators who offer these cleaning compounds

E. I. du Pont de Nemours & Co. (Inc.)
Industrial and Biochemicals Dept.,
RM N-2543HP
Wilmington 98, Delaware

Name_____

Firm_____ Title_____

Address_____

City_____ State_____

EQUIPMENT DEVELOPMENTS

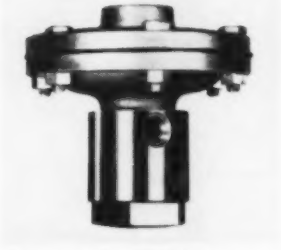
Continued

"Handi-Arc" electrode holder has following features: tip grip on electrodes permits use of electrodes down to short stub; heavy duty milled copper jaws adjustable to accommodate rods of different diameters; improved push button ejector. All working parts are of machined copper.

Room Thermostat . . .

. . . in low-voltage, bimetal design—*White-Rodgers Co., Dept. HPAC, 1209 Cass Ave., St. Louis 6.*

"Customline 130" room thermostat has large dial with embossed gold numerals and recessed pointer type thermometer. Single wiring entry hole in frame adjacent to terminals. Dimensions: height, 4 5/16 in.; width, 2¾ in.; depth, 1 3/16 in. Range adjustable from 55 to 85 F.



Block and Vent Valve

. . . designed for control air service utilizing one operator—*George W. Dahl Co., Inc., 86 Tupelo St., Bristol, R. I.*

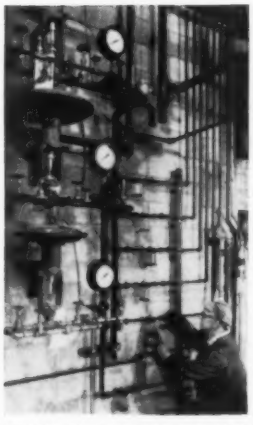
Body pressure rating for ¼ in. block and vent valve is 30 psi and body temperature rating is for ambient air only. Air flow is straight through at pressures of 5.5 psi or greater; as operator pressure drops

SPANG Distributor: W. T. Andrew Company, Detroit, Michigan
Mechanical Contractor: Harrigan & Reid Company, Detroit, Michigan

SPANG Pipe gives Rinshed-Mason, paint manufacturers, the top-quality performance they need for their solvent lines.

"In 40 years of buying SPANG, we've never received one foot of defective pipe"

says Mr. William J. Whelan, Purchasing Agent for Harrigan & Reid Company, Detroit, Michigan



SPANG Pipe plays an especially important role at the inert gas reducing station. Any pipe failure in this system could be costly in terms of paint spoilage; finest materials must be used to insure reliable performance.

"*Reliability* is the one word that best characterizes SPANG Steel Pipe" reports Mr. Whelan. "Actually, there are three good reasons why we buy SPANG Pipe: one, SPANG prices are competitive in every respect; two, delivery adheres to promised commitments; three, SPANG quality is consistently high.

"In this piping installation at Rinshed-Mason Company, a major paint supplier for the automotive industry, *top-quality* pipe was especially important. Besides the plumbing and heating systems, we used SPANG Pipe extensively in the paint-processing system. This process piping carries raw materials and intermediate products from storage tanks to weighing tanks, then to production equipment.

"Altogether, approximately 40 different kinds of liquids are carried by this process piping, including vegetable oils, phthalic anhydride, and a variety of 16 solvents."

SPANG CAN MEET YOUR REQUIREMENTS, TOO. Whether you're installing plumbing and heating systems or more demanding systems of process piping, *quality-controlled* SPANG Steel Pipe is your best bet for reliable installations. Call your local SPANG Distributor for the *top-quality* steel pipe . . . SPANG Steel Pipe.

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

Chicago's Builders Building converts to ENTERPRISE Combination Gas-Oil Burners

—combines modernization with real heating economy

Three Enterprise Burners, each rated 330 HP, provide dependable heat for the Builders Building's half-million square feet of space.

Users, Engineers, Contractors—all agree:

"Enterprise is first choice of heating experts"

"We made this conversion from coal to 3 Fully Automatic Enterprise Gas and Oil Burners in 1957," says Mr. John M. Darr, Building Manager. "At the same time we reduced our boilers from high to low pressure. This change has resulted in savings exceeding our projected figures. Operation has been more than satisfactory."

This is typical of Enterprise Burner performance. Whatever your heavy duty commercial or industrial application, look to Enterprise for the finest in a complete range of oil and combination oil and gas burners from 4 to 200 gph. Complete information and illustrated specification sheets available on request.

Installed by Enterprise Heat and Power Co., Chicago

The Choice of Heating Experts

ENTERPRISE

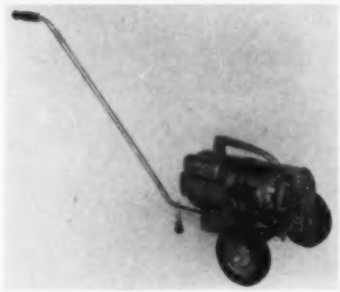
DEPENDABLE BURNERS

ENTERPRISE ENGINE & MACHINERY CO. • 18TH AND FLORIDA STS., SAN FRANCISCO, CALIFORNIA

EQUIPMENT DEVELOPMENTS

Continued

to 3.5 psi, air service is blocked; at 2 psi or less, cavity between blocked ports is vented to atmosphere.



Air Sampler . . .

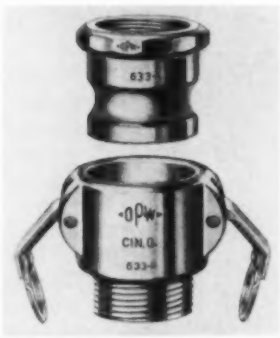
. . . intended for sampling dusts, fumes, gases—*Gelman Instrument Co., Dept. HPAC, P. O. Box 86, Chelsea, Mich.*

"Hi Volume Caddy" air sampler inhales air at rate of 4 cfm. Completely mobile air mover actuated by graphite ringed pistons driven by 1/3 hp motor.

Electric Thermometer . . .

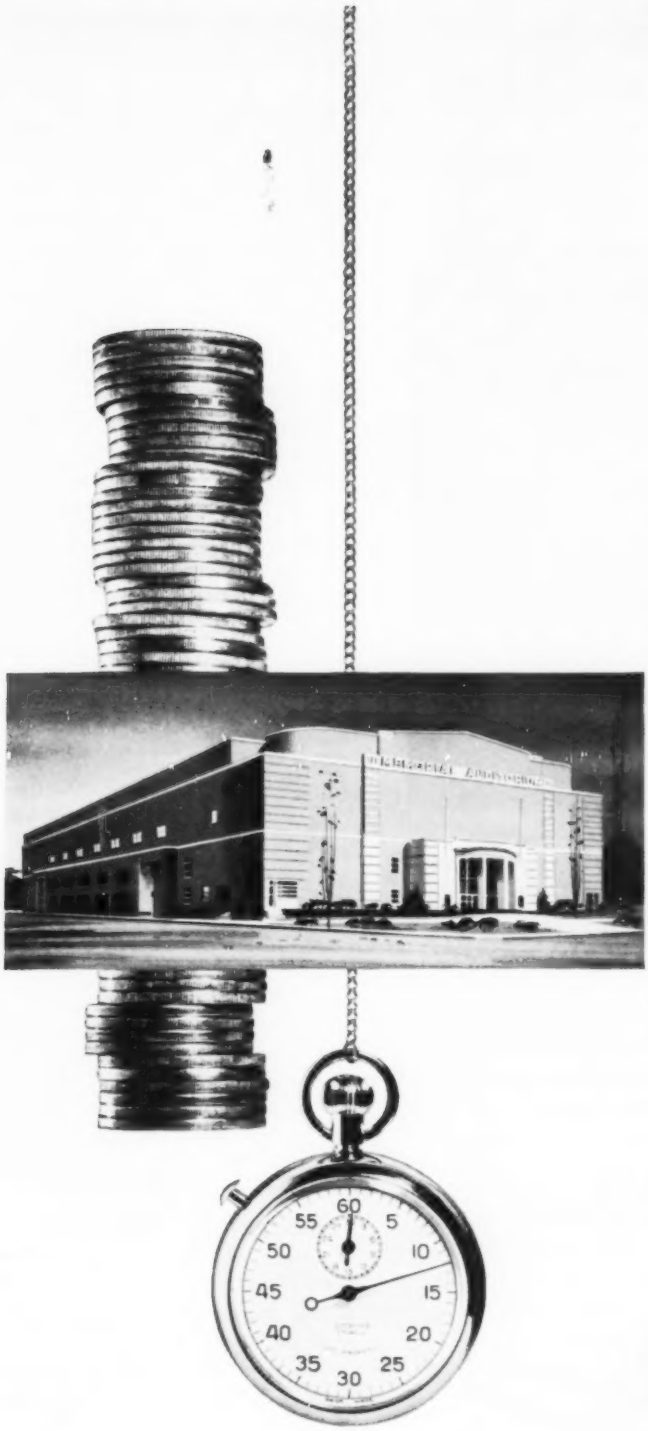
. . . for variety of applications—*Pyrometer Service Co., Dept. HPAC, 348 River Rd., North Arlington, N.J.*

By selecting proper pickup element, "Model 1331" pyrometer measures temperature from −100 to 400 F on flat or curved surfaces. Unit has quick disconnect interchangeable detectors; said to take temperature at any angle or deflection.



Quick Couplings . . .

. . . with "Viton-A" gaskets intended for use with chemicals, tough steam services—*OPW Corp., Div. of Jordan Corp., Dept. HPAC, 6013 Wiehe Rd.,*



Climate by Chrysler

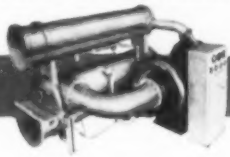
500 tons of cooling power from a 400-hp motor brings double savings to new Greenville Auditorium

A 500-ton Chrysler Centrifugal Liquid Chiller is the heart of the air conditioning system in the new Memorial Auditorium in Greenville, S. C. It cost less to install . . . and every second it operates, it's saving more money. Here's why:

Chrysler's exclusive true volute compressor casing design reduces horsepower requirements per ton of air conditioning. So Greenville saved money on initial costs by using a 400-hp motor . . . instead of the 450- to 500-hp motor needed by similar units. Operating costs are lower, too . . . because the smaller motor takes less power.

Whether there are 7,000 people—or 700—inside the auditorium, this versatile system handles the load perfectly. With Chrysler's exclusive adjustable guide vanes, output of the system can be reduced to 10% of maximum capacity, providing the most economical operating conditions for any size audience.

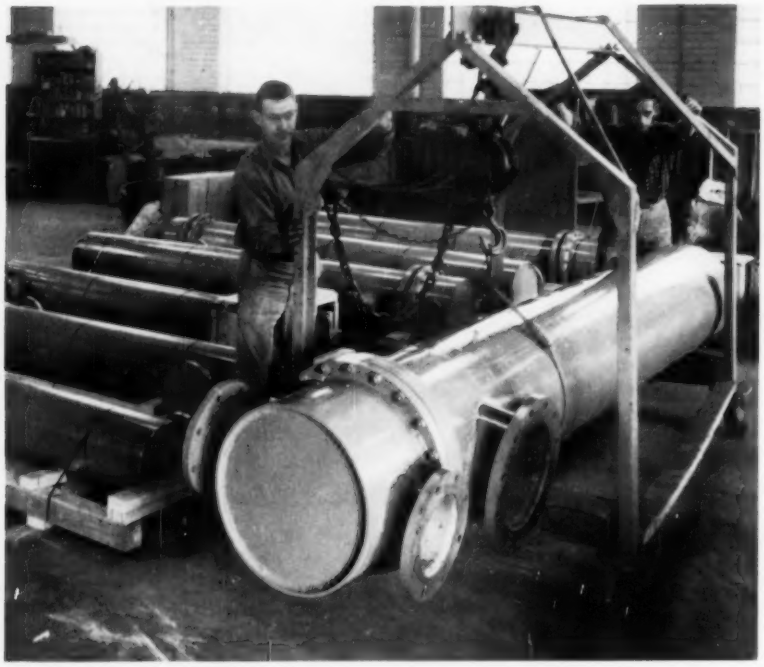
No matter how large the air conditioning job, Chrysler Liquid Chiller equipment can be custom-engineered to your needs. For complete information, contact your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. Y-79, Dayton 1, Ohio. In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario.



CHRYSLER AIRTEMP

FIRST WITH THE FINEST IN AIR CONDITIONING

LARGE or SMALL . . .
General makes 'em all!



GENERAL Application-Rated Converters

can meet <u>all</u> your space heating requirements!

From 1 to 1800 GPM . . . in 4″ to 28″ diameter sizes . . . there's a General Converter designed to suit your exact radiation or space heating requirements. The high efficiency, economy, and endurance built into each model results from General's continuous engineering research, years of manufacturing experience, and strict quality control procedures.

Selected for some of the country's largest installations, General Converters daily prove that progressive design, quality materials and manufacturing skills are the best ingredients for superior performance. General also produces a complete line of converters utilizing a hot water source. Request Bulletin 63A for full details.

GENERAL FITTINGS COMPANY

EAST GREENWICH • RHODE ISLAND

EQUIPMENT DEVELOPMENTS
Continued

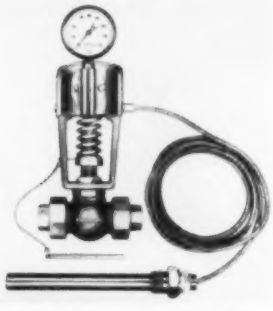
Cincinnati 13.

"Kamlok" quick couplings suitable for pressures to 200 psi and temperatures to 500 F. Available from stock in ½ to 6 in. sizes in aluminum, bronze, monel, stainless steel. Two bulletins, "SRB 17-59" and "F-10-4", give specifications, description, illustrations of product.

Belt Drive . . .

. . .with steel cable cords imbedded in neoprene fully molded with nylon base fabric—*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee* 1.

"Time-Tex" timing belt drives designed to combine advantages of company's "Texrope" drives with those of chain and gear drives. Said to be suitable to range of applications from sub-fractional to 600 hp with torque load range from thousands of foot pounds down to loads in inch ounces. Drive range: zero to 16,000 fpm. Available in five pitches: 1/5, ⅜, ½, ⅞, 1¼ in.

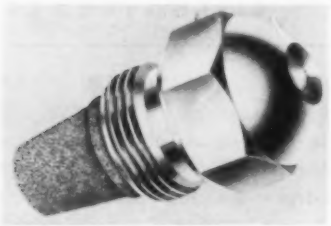


Temperature Regulator

. . .with corrective action within 1/10 F—*Manning, Maxwell & Moore, Inc., Dept. HPAC, 250 E. Main St., Stratford, Conn.*

Temperature regulator controls temperature through throttling action of valve on steam or water line, reponding with corrective stroke with less than 1/10 F change in temperature at the bulb. Indicating temperature regulator (with adjustable dial thermometer), and non-indicating model available in sizes from ½ to 2 in. Ranges are from −15 or 50 to 240 or 350 F.

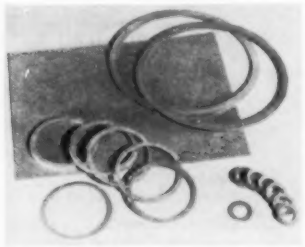
EQUIPMENT DEVELOPMENTS
Continued



Nozzle Filter . . .

. . .designed for longer wear, greater filtering area—*Wm. Steinen Mfg. Co., Dept. HPAC, 43 Bruen St., Newark, N. J.*

One piece porous bronze nozzle filter has following features as cited by manufacturer: firm seal; maximum firing efficiency of nozzle; cone-shaped wall designed for easier flow.



Gaskets . . .

. . .developed to combine advantages of cork with silicone rubber—*Armstrong Cork Co., Dept. HPAC, West Liberty St., Lancaster, Pa.*

"LC-800" compound gaskets combining cork and silicone rubber said to allow much higher temperatures than before. Material made in ribbon and lathe cut rings, both extruded and laminated, as well as mats, sheets, die-cut parts.

Fan Motor . . .

. . .said to be shorter and lighter than standard NEMA "Type D" flange motors of same rating—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

Designed for such applications as mounting with fans, blowers, motors can be mounted in either horizontal or vertical position. Available in polyphase, dripproof and enclosed construction from 1 to 5 hp at 1800 rpm. ∓

THE MARK OF QUALITY
BARBER COLMAN

Motor Operators for control of

valves, dampers, sequencing devices and other similar applications

Barber-Colman offers a line of electric motor operators for operation of a wide variety of control mechanisms. A few applications include steam and water valves, butterfly valves, multiple ratio fuel valves, oil and gas burners, Vortex control, speed-changing screws, exhaust dampers.

FEATURES

Control Forms
Two-position, floating, proportional.

Valve Linkages
Wide variety of factory-assembled Barber-Colman motor-operated valves available. Motor operators may be used to operate other makes and types of rotary or slip-stem valves.

Output Torque Range
16 to 750 lb in.

Adjustable Timing
Optional.

Power Requirements
24, 115, or 230-volt, a-c only.

Limits of Travel
180° standard. Other limits available.

Auxiliary Switches
Some models incorporate built-in auxiliary switch. Auxiliary switch kits available for others. Adjustable.

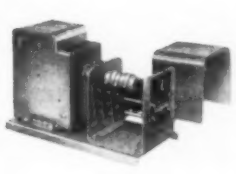
Output Shaft
½" or ¾" diameter, depending upon output torque.

Gear Train
Precision-hobbed gears.

Typical Motor Operator

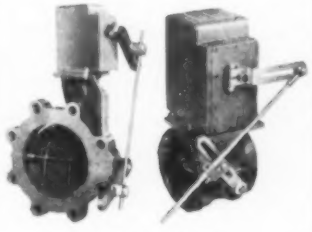
Adjustable Drive Crank
Crank arm range adjustable from ⅞" to 3⅛". Adjustable on shaft through 360°.

Oil-Submerged
Barber-Colman shaded pole induction motor and gear train sealed in oil for long life and maintenance-free operation.



Sequence Controller

Globe Valve



Butterfly Valves

Proportional Motor Operator with Integral Temperature Sensing Bulb and Control Mechanism.

Provides proportional control of temperature regulating devices—a control system in itself for many applications. Can be used on any valve assembly or controller normally furnished with Barber-Colman proportional operators. Positive positioning. Adjustable throttling range. 10 feet of armored capillary furnished as standard. Two-wire connection to any convenient 115-volt power source.

Call your Barber-Colman control office or write today, outlining your requirements.

"Better Control . . .Electrically"

BARBER-COLMAN COMPANY

Dept. S, 1301 Rock Street, Rockford, Illinois, U. S. A.

Drop Forged from Solid Billets...

FORGED STEEL FITTINGS

Heat . . . pressure . . . turbulence . . . oxidation . . . vibration . . . reduction . . . shock. For critical installation problems like these, get maximum protection with W-S Carbon, Stainless and Alloy Steel Fittings.

- Drop forged to produce exceptionally high tensile and impact strength.
- Long accurate threads, in perfect alignment, for ease of installation.
- Heavy uniform fitting wall thickness—an important safety factor.
- Accurate machining to fit tight.

For your next order, call your nearby W-S Distributor. You'll find him ready with comprehensive stocks of the complete line of W-S high-quality fittings. *Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, New Jersey.*

FORGE AND PORTER FITTINGS DIVISION

H.K. PORTER COMPANY, INC.

Divisions: Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Mouldings, National Electric, Refractories, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

RECENT TRADE LITERATURE . . .

▸ *AIR CLEANING EQUIPMENT*—New 16 page bulletin "No. 518" gives description of company's complete line of products. Publication illustrates describes products for air filtering, cooling, heating, cleaning (controlling process dust), moving, exhausting, humidifying, dehumidifying air. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

▸ *AIR-CONDITIONING SUPPLIES*—Revised "Dependabook" catalog of air conditioning, refrigeration supplies presents distributor's complete line of parts, equipment, etc. New 72 page publication contains illustrations, product specifications and descriptions. *Harry Alter Co., Dept. HPAC, 1717 S. Wabash Ave., Chicago.*

▸ *AIR COOLED CONDENSERS*—New technical publication gives details on manufacturer's air cooled condensers, including multiple circuit application data, application information on condensing pressure controls. Diagram of "CPC" air cooled condenser system shows relation of components, outlines steps to avoid extremely low condensing pressures. *Drayer-Hanson, Dept. HPAC, P. O. Box 2215, Terminal Annex, Los Angeles 54.*

▸ *AIR WASHERS*—Illustrated, 4 page bulletin describes company's new air washer units, entirely fabricated of PVC. Operation, construction shown in illustrations and diagram, described in text. *Industrial Plastic Fabricators, Inc., Dept. HPAC, Endicott St., Norwood, Mass.*

▸ *ALUMINUM TUBING*—New 31 page edition of "Aluminum Catalog" presents information on drawn aluminum tube and extruded aluminum tube. New Catalog includes data on metallurgical aspects of manufacture;

Dwyer
CONTROLS GAGES

AIR VELOCITY METER
No. 400

One Instrument Tells Both Air Velocity and Static Pressure!

- Reads directly in feet per minute and inches of water.
- Check all velocities from 400 to 10,000 F.P.M.
- All static pressures from 0 to 10" of water.

Tests fan and blower discharge and inlet pressures, pressure drop across filters, balances air conditioning systems, etc. Complete kit includes dual purpose manometer, 18" stainless steel pitot tube, Magneclip mounting panel and all necessary fittings, tubings, instructions and accessories.

Write today for literature and prices.

F. W. DWYER MFG. CO.
P.O. Box 373-H Michigan City, Ind.

RECENT TRADE LITERATURE

Continued

mechanical, physical, chemical characteristics; tolerance standards; extrusion definitions; range of sizes. *Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC,* 17200 *Southfield Rd., Allen Park, Mich.*

▸ *BOILER BURNER*—New, illustrated 4 page bulletin "No. GO-300-B" presents company's "TF" Scotch marine boiler burner. Publication illustrated with photos; ratings given in tables. *Mettler Co., Inc., Div. of Eclipse Fuel Engineering Co., Dept. HPAC,* 1101 *Buchanan St., Rockford, Ill.*

▸ *CENTRIFUGAL PUMPS*—"Catalog D-101" contains outline dimensions, design and material data and performance curves for company's line of centrifugal pumps. Recommended for application with air conditioning systems, cooling tower systems, other package equipment. *C. H. Wheeler Mfg. Co., Pump Div., Dept. HPAC,* 19*th and Lehigh Ave., Philadelphia* 32.

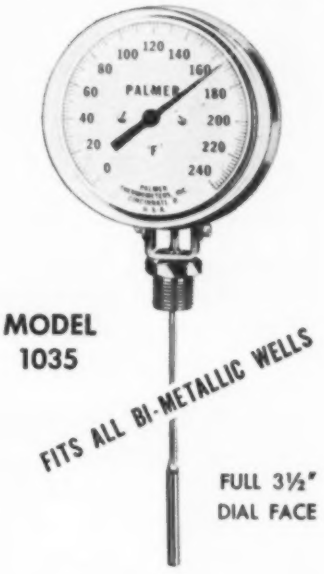
▸ *COLORIMETRIC ANALYZER*—Bulletin describes "Chemalyzer" comparator for automatic determinations of water hardness, pH, residual chlorine, phosphate, hydrazine, dissolved iron concentration. Analyzer has one moving part, works entirely by hydraulic displacement; requires no pneumatic power for operation. "Bulletin 858" describes operation, application, design specifications of instrument, includes 3 part illuustration of automatic steps in each analysis. *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Lane, Philadelphia* 18.

▸ *DEAERATORS*—Company's bulletins "101," "201," "301" present technical data on company's "Duo Pac Series 100, 300" and "Mono-Pac Series 200" deaerators. Complete specifications and dimensional data given in tables for each series. Each bulletin illustrated with detailed

Outstanding Accuracy

PALMER

Dial Thermometer



Check these functional features

- Direct-drive Bourdon Coil with a filled system for longer lasting accuracy.
- Stem can be placed at any desired angle and case can be rotated to most readable position.
- External calibration for zero setting.
- Unaffected by stem alignment.
- Accurate to one scale division.
- No sticking at any temperature.
- Non-corrosive case.

PALMER
THERMOMETERS, INC.
Mfrs. of Industrial Laboratory, Recording and Dial Thermometers
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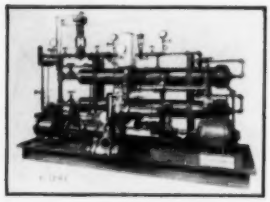
For Oil and / or Gas Fuels

• Fully Automatic • Low Fire Start • Electric-gas Ignition • Modulating Fire Control • Damper Sequence Control • Forced Draft Combustion Air • Electronic Combustion Safety Supervision • Mechanical Atomizing—Steam assisted internal mixing oil burner • Ring or Cylindrical type Gas Burner for gas fuel

For complete details, specifications, illustrations and dimensions write today for Bulletin No. 28.

by NATIONAL AIROIL



FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL makes a complete line of Fuel Oil Pumping and Heating Units for preparing heavy fuel oil for combustion for all types of Oil Burners. Illustrated is a compact, space saving Unit for 2000 Boiler H. P. installed in a large Meat Packing Plant.

Send for Bulletin No. 40 which illustrates and fully explains our wide variety of Pumping and Heating Units.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

MANNING & LEWIS ENGINEERING CO.
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WORKING PRESS:- SHELL TUBES
UNIT NO. JOB NO.

FUEL OIL HEATERS WATER HEATERS and COOLERS

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Heat Exchangers
Condensate Coolers
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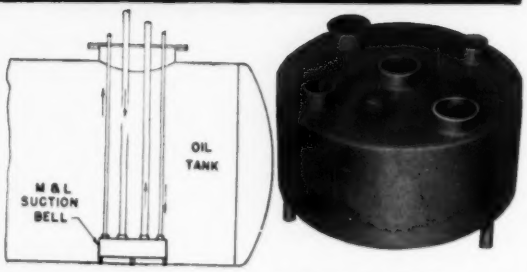

PRESCRIBED FOR ALL HEAVY OIL STORAGE TANKS

M & L Suction Bells are important accessories in any oil burning system, upon which the success or failure of the entire system may depend. Their function is to prewarm the oil in cold weather so as to permit pumping to the oil heater. They are economical units, very simply installed within the storage tank.

M & L Suction Bells are, in effect, localized heating devices with piping connections so arranged that the oil is withdrawn and excess heated oil is returned through it. This combination of coil heating, using steam or hot water, and the return of the excess heated oil from the oil preheater and burner system, affords localized heating without wasteful heating of the entire tank contents. For complete details write for Bulletin 743.

Dept. "D"

Manning & Lewis

28-42 OGDEN STREET NEWARK 4, NEW JERSEY

M L

RECENT TRADE LITERATURE

Continued

working diagrams. *Kittredge Engineering Co., Dept. HPAC, Philadelphia.*

▸ *DIFFERENTIAL PRESSURE INDICATOR*—New bulletin "A-109" describes differential pressure indicator method of operation, dimensions, materials of construction, optional features. "Deltadyne" unit intended for use in −65 to 275 F systems at pressures to 5000 psi. *Aircraft Porous Media, Inc., Dept. HPAC, 30 Sea Cliff Ave., Glen Cove, N. Y.*

▸ *DUST COLLECTOR*—New 20 page product bulletin describes "Type D Roto-Clone" dust collector. Publication provides information on application, principle, design, construction, operation, installation, arrangements. Includes 17 charts and graphs giving performance characteristics, capacity tables, shipping weights, pipe resistance, general air engineering data. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

▸ *ELECTRIC BASEBOARD HEATING*—New 4 page booklet presents company's electric baseboard heating system combining circulating hot water with electricity. Publication discusses heating unit's operating principles, safety, economy, other features; also provides installation and specification data. *International Oil Burner Co., Heat Div., Dept. HPAC, 3800 Park Ave., St. Louis 10.*

▸ *ELECTRONIC AIR CLEANER*—Recently published bulletin describes new line of high velocity "Electro-Cell" electronic air cleaners. Efficiency rated up to 97 percent; capacities from 1000 to 240,000 cfm. Electronic principle of operation described; collector cell construction and basic design also explained. Specifications, shipping weights, capacities, dimensions given. *American Air Filter Co., Dept. HPAC, 215 Central Ave., Louisville 8.*

RECENT TRADE LITERATURE

Continued

▸ *ELECTRONIC THERMOMETERS*—New "Bulletin B" describes "Thermophil" resistors developed for temperature measurements in range between −328 and 845 F, with accuracy of ± 0.25 F on short span instruments between −60 and 120 F. More than 100 interchangeable probe designs available from company. Brochure lists temperature ranges, complete specifications, applications. Complete ordering instructions and available related equipment also given. *Atkins Technical, Inc., Dept. HPAC, 1276 W. Third St., Cleveland* 13.

▸ *EVAPORATIVE COOLER MOTORS*—"GEA-6891" is designation of 2 page publication dealing with latest design features of shaded pole "Slim" motors for evaporative cooler applications. New integral stator insulation now used on motors also discussed. *General Electric Co., Dept. HPAC, Schenectady* 5, *N. Y.*

▸ *EVAPORATIVE CONDENSERS*—Illustrated, 4 page bulletin gives information on complete installation of company's evaporative condensers. Photos illustrate existing installations, text outlines possible savings through use of these units. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▸ *FILTER FABRICS*—New 8 page bulletin describes products, facilities, services of company offering line of imported, domestic filter cloth, yard goods and fabricated, filter specialty items, and free filtration counseling and testing service. Illustrated brochure includes information on cloth analysis, physical and chemical characteristics of filter fabrics. *Technical Fabricators, Inc., Dept. HPAC,* 136 *Washington Ave., Nutley, N. J.*

▸ *FINNED TUBE*—New product reference catalog on company's "Trufin" integral finned tube announces 13 percent increase in outside surface area of "Admiralty Type S/T" line. Surface increase is result of re-

RAND CORPORATION
Santa Monica, California
Not just glass, but entire wall is protected against solar heat and glare by this facade installation of KoolShade Sunscreen. Note pleasing appearance.

Beat solar heat and glare ...the modern KOOLSHADE way

• The *original* solar screening, KoolShade Sunscreen provides the most effective method known for shading windows against solar heat and glare. Here are 8 big reasons why:

① **Keeps interiors cooler.** By screening out up to 89% of the sun's hot rays, KoolShade keeps interiors 15% cooler and more.

② **Saves on air conditioning.** By reducing solar load, KoolShade minimizes initial tonnage requirements ...cuts operating costs. (By rule of thumb, 100 sq. ft. of KoolShade reduces cooling load by approximately 1 ton.)

③ **Reduces solar glare.** Widely used as a daylighting aid, KoolShade moderates sun and sky glare. Screens out direct solar rays to improve lighting balance, guards against eye-strain.

④ **Gives full outward visibility.** Because it's woven (not stamped), KoolShade permits up to 83% clear outward visibility...greater view by far than *any* comparable shading device.

⑤ **Enhances building appearance.** In harmony with all architecture, KoolShade introduces sleek uniformity to all visual openings.

⑥ **Virtually no maintenance.** Because it can't rot, rust or corrode, KoolShade upkeep is negligible. Nubelon-coated, too, for utmost weather resistance.

⑦ **New written warranty!** With KoolShade Sunscreen and KoolFrame Extrusions you now get a written warranty of quality.

⑧ **Franchised installation.** For maximum satisfaction and performance, KoolShade is sold and installed only by Franchised, factory-trained distributors.

SEND TODAY for this free illustrated bulletin. Find out how you, too, can solve your solar problems with modern KoolShade. No cost or obligation.

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Miracle NP555 is a specially formulated duct sealer with excellent aging properties, resulting from use of non-oxidizing raw materials. NP555 has been custom made to **effect substantial economies for you — savings of up to 40% have been reported from many sheet metal contractors who have used this sealer!**

NP555 Duct Sealer has excellent shelf life, and rarely has to be thinned. It's a pleasure to work with NP555 because of the mild solvents it contains. NP555 Duct Sealer creates a tenacious bond to metal, and provides a sure permanent seal around seams. Use NP555 between all sections of spiral conduits and fittings — between risers and run-outs — between run-outs and air conditioning units.

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250 Pettit Avenue, Bellmore, L. I., N.Y.

RECENT TRADE LITERATURE

Continued

development of fin contour. Reference catalog lists sizes, alloys, heat transfer data, etc., for many types of integrally finned tube available from manufacturer for heat transfer applications. *Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC,* 17200 *Southfield Rd., Allen Park, Mich.*

▸ *FLEXIBLE HOSE* — Company's bulletins "83" and "84" outline uses of flexible hose in air handling and fume control. Both publications illustrated throughout with photos. Specifications tables included in each. *Flexaust Co., Div. of Callahan Mining Corp., Dept. HPAC,* 100 *Park Ave., New York* 17.

▸ *FLEXIBLE RUBBER PIPE*—New brochure describes "Condor" flexible rubber pipe, designed for use in applications requiring resistance against corrosion, abrasion, vibration, thermal expansion. Each length of pipe can be rotated to distribute wear over entire inside surface. *Raybestos-Manhattan, Inc., Manhattan Rubber Div., Dept. HPAC,* 61 *Willett St., Passaic, N. J.*

▸ *GAS BOOSTERS*—Catalog "No. 359" describes company's rotary positive air and vacuum pumps, air motors and gas boosters. New 16 page publication gives details of construction, dimensions, capacities, new performance curves, installations. *Leiman Bros, Inc., Dept. HPAC,* 102 *Christie St., Newark* 5, *N. J.*

▸ *GAS BURNERS*—New bulletin "G-400-B" describes company's packaged gas burner unit available for firing maximum of 14,000,000 Btu per hr. Burners complete with piloting flame failure and controls. Designed for firing where there is assured negative draft in combustion chamber, and on any available commercial gas. *Mettler Co., Dept. HPAC,* 1101 *Buchanan St., Rockford, Ill.*

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Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

This AIR-e-ATED Radiant Heat, exclusively Shaw's, is distributed in unvarying, health-guarding proportions that only Nature—*at her best*—can rival.

AIR-e-ATED Radiant Heat is the result of Shaw's fully self-contained construction, featuring full length steel heating fins and exterior radiant panels *all tightly bonded to the copper heating coils.* Shaw units — panel or baseboard—are but 3" thick, easily handled and installed. Choice of same end or opposite end tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

Write today for free literature SP-17

SHAW-PERKINS MFG. CO.
201 EAST CARSON ST., PITTSBURGH 19, PA.

RECENT TRADE LITERATURE

Continued

▸ *HEAT EXCHANGERS*—New 4 page bulletin "No. 581" describes manufacturer's line of heat transfer products, including: hairpin heat exchangers; fired indirect heaters; tank heaters; process heaters; packaged boilers; custom built equipment. Description of heat transfer tubes used in all of company's equipment also given. Products illustrated in photos. *Brown Fintube Co., Dept. HPAC, 508 Huron St., Elyria, Ohio.*

▸ *INDUCED DRAFT FANS*—Complete line of induced draft fans described in 16 page bulletin "L-3." Newly released publication describes advantages of fans, illustrates features with photos, detailed drawings, schematic diagrams of installations. Charts of ratings and specifications also presented in bulletin. *Lehigh Fan & Blower Div., Fuller Co., Dept. HPAC, 124 Bridge St., Catasauqua, Pa.*

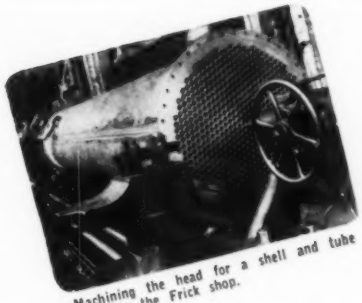
▸ *IMMERSION WATER HEATER*—"Model BT" blast immersion water heater illustrated, described in 4 page brochure, "No. 5220." Listings include size range of available shells, storage capacity, hourly Btu input and hourly recovery capacity. Construction details of blower, burner assembly, accessories also shown. *Sellers Engineering Co., Dept. HPAC, 4876 N. Clark St., Chicago 40, Ill.*

▸ *LIQUID LEVEL CONTROL*—"Bulletin 3004" describes company's new "Series 1800" line of liquid level control available for pressure ranges from 0.02 to 100 psi and to 30 in. water gage. Controls operate on hydrostatic pressure principle; pressure actuates combination of electrical components to perform variety of electrical functions. Available in four models. *Petrometer Corp., Dept. HPAC, 43-22 Tenth St., Long Island City 1, N. Y.*

▸ *LIQUID LEVEL AND FLOW CONTROL*—Information on operating and safety controls for variety of applications involving liquid level and liquid flow given in new 24 page bulletin "ERS-A." Application, engineering information, electric wiring diagrams given. *McDonnell & Miller, Inc., Dept. HPAC, 3500 N. Spaulding Ave., Chicago 18.*

▸ *MANUAL STARTER*—New 8 page bulletin "11B1" introduces company's line of manual starters. Bulletin covers design, dimensions, ratings, prices. Manual starters described in publication rated through 7½ hp a-c and 2 hp d-c. *Furnas Electric Co., Dept. HPAC, 1000 McKee St., Batavia, Ill.*

▸ *METAL GAS VENT*—New 16 page catalog covers construction features, typical installations, specifications, ordering information on company's line of vent and pipe fittings. Vent is double-wall, air-insulated system with interlocking joints, available in both round and oval pipe with



Machining the head for a shell and tube vessel in the Frick shop.

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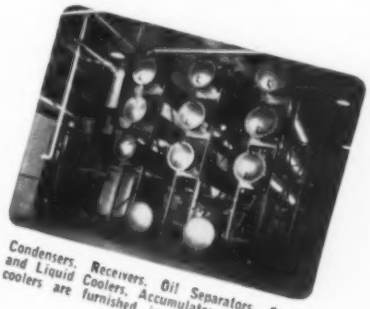
With 106 Years' experience in building pressure vessels . . . from boilers to reactors, we're able and ready to fill all your needs.



Condensers, Receivers, Oil Separators, Gas and Liquid Coolers, Accumulators, and Pre-coolers are furnished in all sizes.

We have the shears, planers, power rolls, automatic welders and mechanics to do this type of work.

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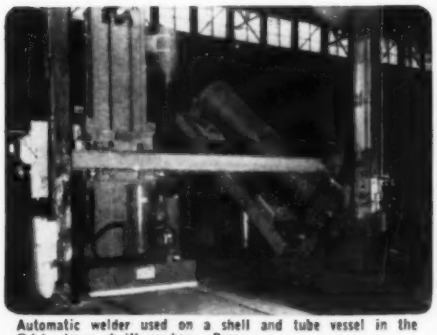
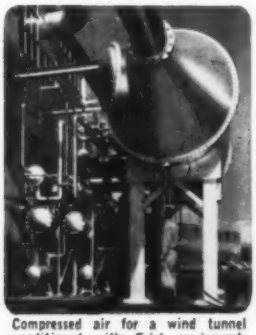


Automatic welder used on a shell and tube vessel in the Frick shops at Waynesboro, Penna.



Compressed air for a wind tunnel conditioned with Frick equipment.

Frick reactor shells are built by ASME qualified welders.

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MOISTURE ELIMINATOR BLADES

for

Industrial Air-Conditioning

are

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SOPLASCO Plastic Moisture Eliminator Blades can not rust due to the physical and chemical properties of the materials developed for this specific use. These blades provide greater efficiency because of less down-time for cleaning and maintenance! Blade replacement is unnecessary and maintenance costs are negligible. Insist on durable, easy to clean, and fire resistant SOPLASCO Blades in your specifications or when blade replacement is necessary.

For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

Southern Plastics Co.

408 Pendleton St.
Columbia, S. C.

RECENT TRADE LITERATURE

Continued

necessary fittings. Unit is listed for type "B" and type "BW" applications. *Van-Packer Co., Div. of Flintkote Co., Dept. HPAC, 1232 McKinley Ave., Chicago Heights, Ill.*

▸ *NOISE CONTROL*—New publication describes company's modular silencing units for air conditioning and ventilating systems ("Mod-U-Size"), and circular silencing units for axial flow fans and higher pressure systems ("Conic-Flow"). *Industrial Acoustics Co., Inc., Dept. HPAC, 341 Jackson Ave., New York 54.*

▸ *PACKAGED BOILERS*—Recently published 8 page bulletin covers new line of mechanical pressure atomizing oil-fired, and partial pre-mixing gas-fired "Powermaster" packaged automatic boilers. Publication contains data, illustrations on sizes from 20 through 100 hp. *Orr & Sembower, Inc., Dept. HPAC, Morgantown Rd., Reading, Pa.*

▸ *PIPE FITTINGS*—Use of company's couplings, fittings, other piping products for industrial piping described in new 8 page catalog, "Form No. 259." Catalog contains product information, installation instructions, specifications; illustrated with photos. *Dresser Mfg. Div., Dresser Industries, Inc., Dept. HPAC, 49 Fisher Ave., Bradford, Pa.*

▸ *PIPELINE FILTER*—New "Air Line Ultra Filter", designed for use with compressed air and other gas lines, is described in bulletin "No. 1505-7." Said to provide removal of 99 percent by particle count of particulate matter 0.3 micron and larger in diam at rated flows. Accessory elements also available for gaseous contaminant removal. *Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*

▸ *PLASTIC DUCTS*—Brochure describes use of exhaust systems of

SAVE TIME— SAVE MONEY

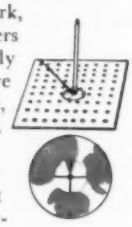
with these dependable

INSULATION HANGERS

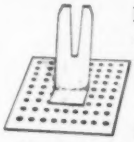
GEMCO

Spindle Hangers and W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

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SALES MANAGER

For long established company located in east which manufactures industrial heating, ventilating and combustion equipment.

Company's sales normally in excess of $4,000,000 per year through manufacturers' representatives in United States and Canada. Company has progressive management and is well financed.

Candidate should have mechanical engineering training, proved record of success as sales manager for industrial products, plus strong leadership and administrative qualities.

Prefer candidate between ages 35 and 48. Earnings of $20,000 plus per year, depending on man. Also possibility of title of Vice-president for Sales.

Interested candidates should send complete resume. Inclusion of small photo is welcome.

Our employees down through clerical level are informed of this opening and the Company's search for good candidates.

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Heating, Piping & Air Conditioning
6 North Michigan Avenue
Chicago 2, Illinois

RECENT TRADE LITERATURE

Continued

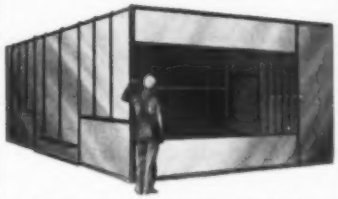
thermoplastics to combat corrosion, cut maintenance, replacement costs. Detailed information given on features of installations made from branch or linear polyethylene, polyprolene, and types I and II polyvinyl chloride. Photos, charts, tables included. *American Agile Corp., Dept. HPAC, P. O. Box 168, Bedford, O.*

▸ *POWDER ACTUATED TOOLS*—New 48 page handbook presents survey on uses of powder-actuated tools, fasteners in construction work. Book contains information on recommended specific loads, also has line drawings of common applications, tables providing data on shear values, tensile values, design limitations, physical properties. *Ramset Fastening System, Olin Mathieson Chemical Corp., Dept. HPAC, 460 Park Ave., New York 22.*

▸ *REFRIGERATION OILS*—Bulletin "A-3895" gives information on selection and use of lubricating oils for refrigeration units. Adapted from ten page article by Edgar A. Ross, company engineering consultant, material covers essential characteristics of refrigeration oils; refinement techniques; significance of properties; effect of refrigeration on oils; lubrication of industrial compressors; splash lubrication; lubrication of bearings and of air conditioning equipment. *Sun oil Co., Industrial Products, Dept. HPAC, 1608 Walnut St., Philadelphia 3.*

▸ *REGISTERS, DIFFUSERS*—New catalog designed for easy, accurate selection of all types of company's air diffusion equipment. New 58 page publication has color key for easier identification of company's four major product groups. Products include wall and ceiling type supply grilles and registers; ceiling and door type return grilles and registers; extruded aluminum airline grilles; accessories and miscellaneous products. Each section has detailed selection tables, illustrations of models within

CAPILLARY ® Air Washers



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RECENT TRADE LITERATURE

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product category. *Waterloo Register Co., Inc., Dept. HPAC, P. O. Box 72, Waterloo, Iowa.*

▸ *SOLENOID VALVES*—New 36 page catalog lists manufacturer's complete line of 200 solenoid valves of bronze, stainless steel construction. Valves available with pressures from zero to 10,000 psi and temperatures from −300 to 500 F; they may be used for air, steam, corrosive and non-corrosive gases and liquids. Illustrated catalog gives valve specifications, performance data, specific application information, optional features. *Aktomatic Valve Co., Dept. HPAC, 545 W. Abbott St., Indianapolis.*

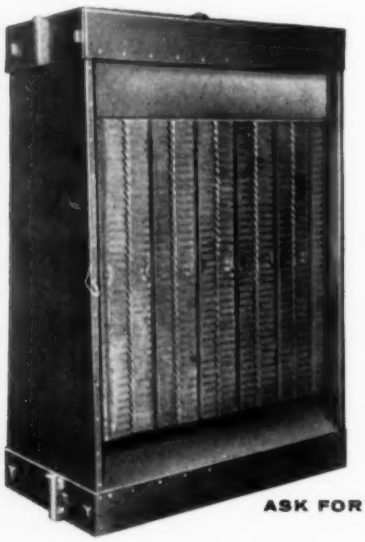
▸ *SOLVING CORROSION PROBLEMS*—New 24 page brochure, entitled, "Solving Corrosion Problems in Industry" presents company's "Duplex" tubes, explains application in petroleum refineries, chemical and petrochemical plants, food processing installations, other fields. Bi-metal tubes designed to provide maximum corrosion resistance in condensers, heat exchangers where two different corrosive media are in process. *Bridgeport Brass Co., Dept. HPAC, 30 Grand St., Bridgeport 2, Conn.*

▸ *STEEL UNIONS*—Detailed specification data on types, sizes, materials, pressure ratings of company's complete line of "W-S" forged steel unions presented in new catalog. Items are illustrated in photos, diagrams. *H. K. Porter Co., Inc., Dept. HPAC, 300 Park Ave., New York 22.*

▸ *SPRAYED COIL DEHUMIDIFIERS*—New, 24 page, illustrated catalog, "Bulletin 9427," describes manufacturer's draw-through and blow-through sprayed coil dehumidifiers. Complete section given to principles of blow-through sprayed coil dehumidifiers and application recommendations. Construction details, optional arrangements, related equipment described and illustrated. Publication also includes table of unit data, selection example, capacity table, curves, other data. *American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

▸ *TEMPERATURE CONTROLS*—"Thermoswitch" controls and mounting wells described in new 8 page booklet "MC-177." Publication includes description of operation of units on differential expansion of metals, complete operating specifications and dimensions, available modifications, special features. *Fenwal, Inc., Dept. HPAC, Pleasant St., Ashland, Mass.*

▸ *THERMOMETERS, HYDROMETERS*—Revised and illustrated catalog "No. 225B" covers company's complete line of "Engraved Stem" thermometers and hydrometers. Publication contains 14 pages of information on pocket type, laboratory, pre-



WILSON
UNIT HEATERS
GUARANTEED TO REDUCE MAINTENANCE COSTS!

Provides large volume of air over wide floor area, continuously, economically. Sturdy enclosure houses the patented Wilson all-cast aluminum radiation element with integrally cast directional fins. Completely eliminates the need for costly, troublesome louvers. Recognized as a unit heater that is completely dependable in service where corrosive atmospheres are encountered. ***Capacities 64,000 to 430,000 BTU.***

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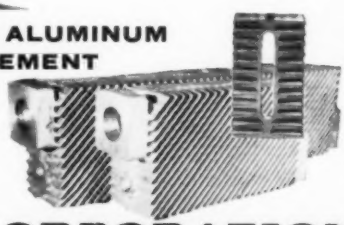
- HIGH THERMAL EFFICIENCY
- EXTREMELY RUGGED
- COMPACT DESIGN

WILSON ALL-CAST ALUMINUM RADIATION ELEMENT

This is the same proved radiation element used so successfully in severe diesel locomotive service. Chamber shape plus the patented 45° directional fin feature provides high thermal efficiency in a compact design. Extremely rugged in construction. High pressure hydrostatic tested.



WILSON ENGINEERING CORPORATION

6 NORTH MICHIGAN AVENUE CHICAGO 2, ILLINOIS

RECENT TRADE LITERATURE

Continued

cision and ASTM thermometers, with special emphasis on temperature and specific gravity instruments for use in petroleum industry. *Weksler Instrument Corp., Dept. HPAC, 195 E. Merrick Rd., Freeport, L. I., N. Y.*

▶ *VACUUM GAGES*—New catalog "No. 525B" presents company's line of indicating gages in 3½, 4, 6, 8½ in. dial sizes in ranges of from 10 in. WG to 10,000 psi. New "SG" safety gage for use with hazardous conditions offered. Recording pressure gages in 8, 10 and 12 in. chart sizes also shown. *Weksler Instrument Corp., Dept. HPAC, 195 E. Merrick Rd., Freeport, L. I., N. Y.*

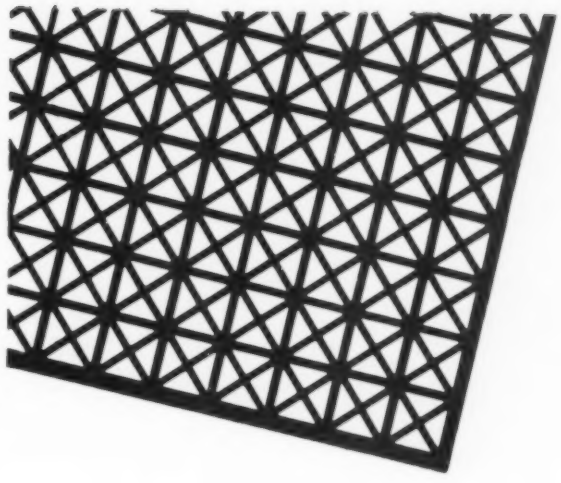
▶ *VALVES*—New 6 page brochure, "Circular No. 601," describes company's line of "Luncor" molded, corrosion resistant PVC valves. Included in publication is table giving manufacturer's recommendations for corrosive applications, also valve sizes, weights and dimensions, installation data. *Lunkenheimer Co., Dept. HPAC, Waverly and Beekmans Sts., Cincinnati* 14.

▶ *VALVES, REGULATORS*—Two-color wall chart gives reference data on company's line of hydronic heating controls, relief valves, pressure regulators, safety devices. Chart opens to 12 × 18 in. size. *A. W. Cash Valve Mfg. Corp., Dept. HPAC, P. O. Box* 191, *Decatur, Ill.*

▶ *WATER HEATER*—Company's "WH Series" tankless, twin coil volume water heater described in new illustrated, 4 page bulletin. Publication explains advantages of indirect hot water system. Gas and oil-fired units designed for variety of large-volume hot water applications. Bulletin offers capacity, dimension charts for 14 sizes of water heaters. *Portmar Water Heater Co., Dept. HPAC, 193 Seventh St., Brooklyn* 15, *N. Y.*

▶ *WELDING FITTINGS AND FLANGES*—Latest in company's series of technical specification bulletins present dimensions, specifications for ½, 1¼, 1½, 2½ and 10 in. sizes of forged steel fittings and flanges. Bulletins "FDC-252, 255, 256, 258, 265" present information in table form, with series of diagrams illustrating each type. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Milwaukee* 46.

▶ *WELDING FITTINGS*—"Catalog H-1" presents company's line of "Husky" fittings, designed for non-critical heating and cooling systems. Catalog lists sizes and styles from 45 and 90 deg elbows, through straight and reducing tees, and concentric reducers. *Nibco, Inc., Dept. HPAC, Elkhart, Ind.* ‡



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Hendrick Architectural Grilles

When an architect draws up specifications for a new building or a modernization proposal he must adhere to two basic principles: FIRST, he must use his head in keeping costs down. SECOND, he must recommend functional materials and components that appeal to his client's decorative motif and sense of beauty. That's why more and more architects specify Hendrick Grilles. Available in hundreds of attractive designs, Hendrick Grilles cost less to buy . . . cost less to install and cost less to maintain! And they provide more-than-ample area for free passage of air . . . always lie flat . . . don't bend or warp. For more information write to Hendrick, today.

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Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles Mitco Open Steel Flooring — Shur-Site Treads • Armorgrids Hydro Dehazers • Petrochemical Column Internals

#625

WHO'S WHAT...

(New personnel, promotions)

▸ *WESTINGHOUSE ELECTRIC CORP.*—Mark W. Cresap, Jr., president and chief executive officer; Gwilym A. Price, chairman of the board.

▸ *CERRO de PASCO CORP.*—Edward F. Schweich, elected president of *LEWIN-MATHES CO.* division; Richard H. Lewin, vice president in charge of domestic nonferrous metal fabricating operations.

▸ *C. G. HUSSEY & CO., DIV. of COPPER RANGE CO.*—John R. Lally, president; John G. McNeely, vice president and director of sales; Ralph W. Myers, vice president and director of purchasing.

▸ *WILLIAMSON CO.*—W. L. McGrath, elected chairman of the board; L. B. Murphy, president; R. L. Herrmann, executive vice president and treasurer.

▸ *ACOUSTICAL SOCIETY OF AMERICA*—Hale J. Sabine, president.

▸ *WATER CONDITIONING FOUNDATION*—Donald L. Porth, president.

▸ *AMES IRON WORKS, INC.*—J. Earl Murray, vice president and general manager; Raymond Schickling, assistant secretary and assistant treasurer; Celia Sherman, secretary.

▸ *MARSH INSTRUMENT CO.*—Bernhard Willach, vice president for engineering.

▸ *MIDWEST PIPING CO., INC.*—Norman B. Champ, Jr., administrative vice president; E. B. Stolle, vice president, Pacific division; T. R. Taylor, Jr., vice president, eastern division; E. M. Hansen, industrial and methods engineer.

▸ *BEAVER PIPE TOOLS, INC.*—Russell Herig, vice president of sales.

▸ *HUDIK-ROSS, INC.*—Harry A. Cohan, Jr., vice president in charge of sales.

▸ *U. S. ELECTRICAL MOTORS, INC.*—G. Liebmann, commercial manager, elected chairman of motor and generator section of *NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION.*

WITH HAGAFILM TREATMENT — WITHOUT HAGAFILM TREATMENT

Central generating station, U.S. Bureau of Mines, Bruceton, Pa. Hagafilm, in use here since 1951, is added with the boiler feedwater to form a protective film on condensate lines.

Quick case history—reading time 58 seconds

How U. S. Bureau of Mines protects miles of condensate lines with Hagafilm

THE PLANT: The U.S. Bureau of Mines experimental station occupies a 259 acre tract of land at Bruceton, Pa. Process and heating steam is generated at a central boiler plant by four 250 H.P. units. There are several miles of steam and condensate return lines connecting the boiler plant with over 100 steam-using buildings.

THE PROBLEM: Plant records showed continuously high maintenance and replacement costs for condensate return lines, traps and valves. Corrosion rates, as measured by pre-weighed test specimens, were 56 mg/dm²/day. (25 mg/dm²/day indicates serious corrosion.) Because of the considerable distances involved, an extremely active and well distributed inhibitor was required to protect vulnerable return lines against oxygen pitting as well as low pH carbon dioxide grooving.

THE SOLUTION: Hagafilm met the Bureau's requirements. A long chain amine inhibitor, Hagafilm forms a non-wettable, protective film on surfaces contacted, starting from the point of condensation. It was initially shot-fed four times daily to the operating boilers at a rate of 2 ppm, based on steam produced. Subsequently, the feed rate was reduced to 1 ppm. Once an adequate film was formed, less Hagafilm was needed to keep the lines in good condition.

TEST RESULTS: Corrosion rates have dropped to 2.7 mg/dm²/day. Trap maintenance and pipe replacements are now almost nonexistent. The top photo illustrates Hagafilm's ability to protect lines from corrosion problems. The pipe section at the right developed a dangerous degree of corrosion after 10 years service without Hagafilm . . . the section at the left shows negligible corrosion effects after 7 years use with Hagafilm added.

FOR FULL INFORMATION on how Hagafilm can solve your corrosion problem safely, quickly and economically, write for bulletin 410-12-7 or contact:

HAGAN CHEMICALS & CONTROLS, INC.
DIVISIONS: CALGON COMPANY; HALL LABORATORIES
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

WHO'S WHAT

Continued

▸ *ALBERT KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC.*—V. C. Wagner, elected to board of directors.

▸ *RANDALL GRAPHITE BEARINGS, INC.*—Ray Chaney, vice president and director of sales.

▸ *GENERAL FITTINGS CO.*—Earl H. Bradley, and Peter G. Leddy, elected to board of directors.

▸ *COMBUSTION ENGINEERING, INC.*—Samuel R. Parry, vice president in charge of manufacturing.

▸ *BABCOCK & WILCOX CO.*—Lauchlin M. Currie, elected to board of directors; John G. Martin, domestic sales manager of boiler division.

▸ *ARKLA AIR CONDITIONING CORP.*—G. J. Tankersley, elected to board of directors.

▸ *YOUNGSTOWN SHEET AND TUBE CO.*—Robert F. Doolittle, elected general counsel and secretary; William J. Harnisch, assistant secretary; Leo DeFiore, director of engineering; Clyde M. Horan, general superintendent of basic steel operations at both Indiana Harbor and South Chicago works; Donald M. Lloyd, general superintendent of steel plant rolling and finishing mills; Robert M. McCafferty, superintendent of continuous butt weld mills; Charles W. White, Jr., superintendent of bloom, billet, bar and skelp mills at Indiana Harbor.

▸ *RHEEM MFG. CO.*—Emerson S. Ronk, elected to board of directors.

▸ *BJORKSTEN RESEARCH LABORATORIES*—Alan G. Richards, vice president.

▸ *H. D. CONKEY & CO.*—A. B. Carlson, engineering vice president.

▸ *ROCKWELL MFG. CO.*—Gilbert T. Bowman, vice president.

▸ *WHEATLAND TUBE CO.*—Karl F. Lukens, vice president in charge of sales, appointed chairman of the committee on steel pipe research by *AMERICAN IRON AND STEEL INSTITUTE*; Theadore R. Anderson, superintendent of company's plant at Wheatland, Pa.

Western Rotary® Roof Ventilators

with Lifetime Guaranteed Bearings

- "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity, no backdraft ever.
- Certified wind tunnel tests by non-commercial national institute.
- Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
- Lock-on rotor, yet removable without special tools.
- Exclusive Western corrugated vane increases rigidity.
- Low, functional type adds beauty.
- Baked enamel paint coating for beauty and long life.
- Aluminum, copper, or stainless steel construction available.

Other type ventilators include:

- Stationary
- Directional
- Continuous ridge
- Vertical exhaust
- Axial roof
- Unit ventilators

Immediate Delivery on all sizes

Complete Catalog in Sweets and Western States A-E-C

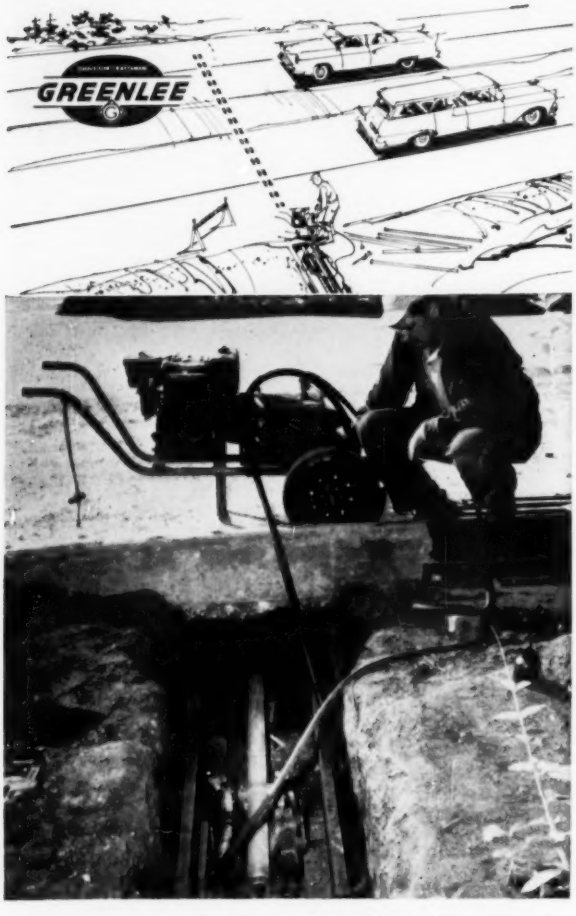
Write for catalog and name of nearest representative.

WESTERN ENGINEERING & Mfg. Co.

4108 Glencoe Avenue, Venice, California

Since 1921 . . . a reliable leader.

EASY, Low-Cost Way to Run Pipe Under Streets, Walks, Floors



Greenlee Hydraulic Pipe Pusher
Hand- or Power-Operated

Traffic proceeds as usual when your piping crosses under streets or sidewalks this simple, timesaving way. Model No. 790 shown pushes $^{3}/_{4}$" - 4" pipe about two feet per minute with power pump. A small ditch in the parkway accommodates the pusher — streets and walks remain undisturbed. Costly tearing up, tunneling, filling, repaving are eliminated . . . total job time and cost are cut to a fraction. The same efficiencies and savings apply on under-floor installations or on pipe-pulling jobs. That's why the GREENLEE Pipe Pusher often pays for itself the first few times used. See your supplier for a demonstration or write for descriptive literature.

GREENLEE LINE OF TIMESAVING TOOLS FOR PIPE FITTERS AND PLUMBERS ALSO INCLUDES PIPE BENDERS, PIPE BITS, POWER BITS

GREENLEE TOOL CO. GREENLEE
1770 Columbia Ave., Rockford, Illinois

WHO'S WHAT

Continued

▸ *SUPERIOR VALVE & FITTINGS CO.*—George R. Allen, vice president, elected to board of directors.

▸ *CARRIER CORP.*—W. T. Brady, president of Corn Products Co., elected to board of directors.

▸ *CRANE CO.*—Warren A. Logelin, director of public relations and advertising department; John P. Magos, director of engineering; Clarence E. Watson, general manager of atomic sales; Darrell R. Nordwall, general manager of branch sales; Charles H. Lovelace, general manager of engineering sales; R. W. Lindsay, general manager of wholesaler sales.

▸ *OPW CORP., DIV. of JORDAN CORP.*—Malcolm C. Myers, manager of product engineering and development.

▸ *UNITED STATES STEEL CORP.*—J. Wayne Lindquist, manager of *NATIONAL TUBE DIV.* standard pipe products.

▸ *FRED S. DUBIN ASSOCIATES*—Edward A. Sobolewski, manager of New York office.

▸ *SVERDUP AND PARCEL ENGINEERING CO.*—John I. Parcel, vice president and director, awarded honorary degree of Doctor of Engineering by University of Illinois.

▸ *HENRY PRATT CO.*—Bruce Ranney, advertising manager.

▸ *A. Y. McDONALD MFG. CO.*—Fred J. Hagy, merchandising manager.

▸ *JOSEPH T. RYERSON & SON, INC.*—Richard C. Leahy, manager of general order and merchandise inventory departments; Ralph A. Castillo, general manager of Houston steel and aluminum distribution.

▸ *TRANE CO.*—William C. Lindsay, sales manager, package equipment department.

▸ *GENERAL ELECTRIC CO.*—R. W. Tribble, manager of project and builder sales; David T. Donavan, specialist in sales planning; William G. Burk, specialist in publicity; Joseph S. Strecker, regional manager of central air conditioning department with headquarters in Tyler, Texas.

WHO'S WHAT

Continued

▸ *YORK DIV. of BORG-WARNER CORP.*—Wilbur S. Miller, manager, marine sales.

▸ *REDMOND CO., INC.*—Edward Lindberg Jr., field sales manager.

▸ *BOHN BRASS & ALUMINUM CORP.*—Edward O. Falberg, division manufacturing manager; Carl F. Brown, plant manager of Greensburg, Ind., plant; Herbert S. Lindahl, chief product engineer, refrigeration; Gordon Kayser, chief product engineer, heating and air conditioning.

▸ *A. M. BYERS CO.*—Richard G. Hume, field service engineer.

▸ *MILWAUKEE VALVE CO.*—William W. Simons, applications engineer; Lawrie C. Radway, product engineer.

▸ *BITUMINOUS COAL INSTITUTE*—Alfred F. Bochenek, development engineer, elected president of Washington, D. C. section of *AMERICAN SOCIETY OF MECHANICAL ENGINEERS.*

▸ *NATIONAL-U. S. RADIATOR CORP.*—Clancy W. Pollock, sales manager for air conditioning products.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—William Fay, chief design engineer for temperature controls group panel division.

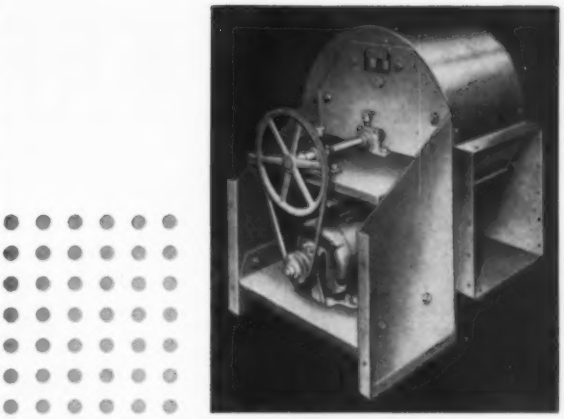
▸ *ALLOY STEEL PRODUCTS CO.*—Richard E. Boller, Jr., general sales manager.

▸ *W-K-M, DIV. of ACF INDUSTRIES, INC.*—Henry C. Tooley, plant manager of Missouri City plant.

▸ *ARMCO STEEL CORP.*—Harold R. Miller, superintendent of maintenance at Butler, Pa., works.

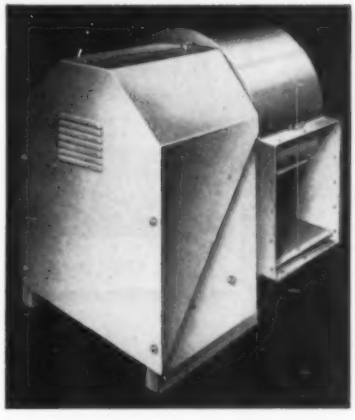
▸ *AMERICAN-STANDARD, DETROIT CONTROLS DIV.*—Robert R. Ashley, manager of manufacturing of Stratford, Conn., plant.

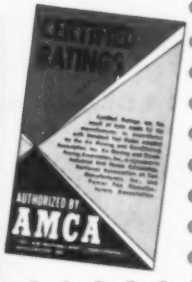
▸ *ALLIS-CHALMERS MFG. CO.*—Howard R. Hammond, general manager of newly created defense products division; Joseph J. Jacobs, assistant chief engineer of West Allis pump department of general products division.



Aladdin
AIR HANDLING EQUIPMENT

UTILITY SETS





TEN SIZES • COMPACT • BELT DRIVEN
SELF CONTAINED • QUIET OPERATING

ALADDIN Belt-Driven Utility Sets are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

Write for complete data

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*U.S. REG. T.M.

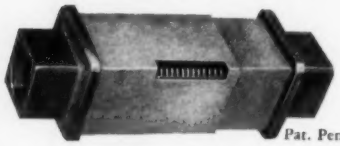
KEFLEX

Stainless Steel Bellows Type
Expansion Compensators
Braided Bronze Flexible Connectors

KEFLEX

*U.S. REG. T.M.

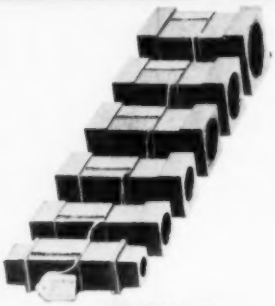
TYPE 7 Q WITH BRASS FEMALE THREADED ENDS
Maximum Pres. 300 PSI Maximum
Temp. 800 F



Pat. Pend.

TYPE 7Q-T WITH COPPER TUBE ENDS
Maximum Pres. 200 PSI Maximum
Temp. 300 F

Pat. Pend.



7 Q QUADRA-SIDE
EXPANSION COMPENSATORS

"BMH" Flexible Connector

"USF" Vibration Absorber

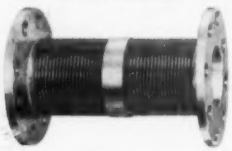
KEFLEX 7Q FINTUBE Assembly

DUAL KEFLEX 7Q With Anchor Base

KEFLEX EXPANSION AND VIBRATION ASSEMBLIES

SLOTTED BOLT HOLES

158-12E EXPANSION JOINT



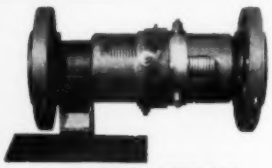
158-15-12E DUAL EXPANSION JOINT

158-15-9E DUAL EXPANSION JOINT

308-14E EXPANSION JOINT

151-2V VIBRATION ABSORBER

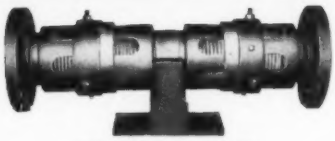
301-4-14S VIBRATION ABSORBER



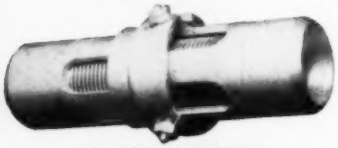
KTO-300-EAB-14E

KEFLEX
With
KETROL GUIDES

Pat. Pend.



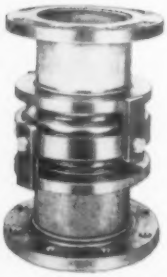
KTO-300-15-CAB-14E



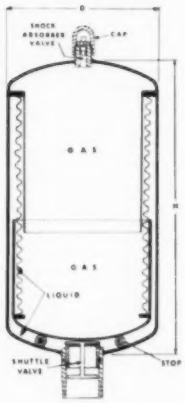
KTO-300-2E EXTENDED

OUTSIDE
GUIDES
CAGE CONTROLLED

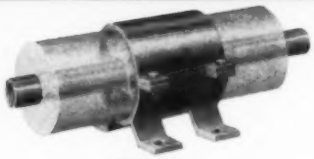
KTO-300-2E COMPRESSED



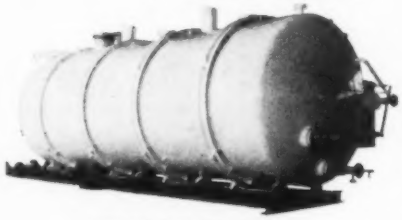
KEFLEX GIMBAL UNIT



TYPE P
KEFLEX PULSCO SHOCK TRAP



TYPE M
KEFLEX MAVE PIPE GUIDE



KEFLEX BELLOWS ON LOX
TANK For Vacuum Service

WRITE FOR KEFLEX BULLETINS
A KEFLEX REPRESENTATIVE IS NEAR YOU

U. S. Flexible Metallic Tubing Co.

Since 1905

KEFLEX MANUFACTURING DIVISION

General Offices—63 Main St., San Francisco 5, Calif.

Factory—Los Angeles

Sales Offices—Agents in Principal Cities of United States and Canada

WHO'S WHAT

Continued

▶ *A. O. SMITH CORP.*—V. H. Swearingen, supervisor of sales service of *PERMAGLAS DIV.*

▶ *SWARTWOUT CO.*—Robert Parshall, sales manager of ventilation division.

▶ *BETTER HEATING-COOLING COUNCIL*—Roy A. Bredholt, director of field services.

▶ *INSTRUMENT SOCIETY OF AMERICA*—Robert T. DeVore, Public relations director.

▶ *PEERLESS ELECTRIC CO., FAN AND BLOWER DIV.*—William M. Gelvin, sales engineer.

▶ *J. E. LONERGEN CO.*—Harold I. Gregg, design engineer.

▶ *MILTON ROY CO.*—H. Freedman, product manager.

▶ *MUELLER CLIMATROL, DIV. of WORTHINGTON CORP.*—Richard B. Schmidt, general sales manager; George M. Hase, manager of product planning; Robert A. Hoehne, manager of sales engineering.

▶ *BELL & GOSSETT CO.*—William Carlisle, assistant to sales manager; Robert De Wyze, manager of training and education department.

▶ *GENERAL ELECTRIC CO.*—Seymour Krewitsky, manager of heating control and special purpose shop operations.

▶ *AMERICAN AIR FILTER CO., INC.*—C. A. Pickett, manager of merchandise division; John W. Frazier, manager of field sales administration.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *COPELAND REFRIGERATION CORP.*—Russell E. Comstock, southeastern district representative.

▶ *TORRINGTON MFG. CORP.*—Gene C. Mix, sales manager of western division.

▶ *CARRIER CORP.*—George H. Wessler, manager of Sacramento, Calif., district.

IMPROVED 30 MODEL, 1,000 THRU

D-H CENTRAL

30,000 CFM, H- AND V-SERIES

STATION AIR CON-

ARE MODULAR CONSTRUCTED

DITIONING UNITS

HAVE INSIDE MOTOR MOUNTING

HORIZONTAL MODEL

THE BEST OF PROVED-BEST FEATURES 'N SOME NEW ONES, TOO: SECTIONALIZED CONSTRUCTION. FULL ACCESS TO ALL EXPOSED AREAS. FRAME, STRUCTURAL STEEL ANGLES, WELDED FOR RIGIDITY. FAN SECTION MAY BE FIELD-ROTATED. FANS, FORWARD CURVE, DIDW, CAST IRON CENTER HUB. EXTRA DEEP COIL SECTION CAN ACCOMMODATE 10-ROW COILS. DRAIN CONNECTIONS BOTH ENDS. INSULATED DRAIN PAN INDEPENDENT OF UNIT. SELF-ALIGNING, LIFETIME LUBRICATED BEARINGS. HIGH, LOW VELOCITY FILTERS. SEND FOR TIME-SAVER "FAN PERFORMANCE CURVES"

d-h SINCE 1930

drayer-hanson

DIVISION NATIONAL U. S. RADIATOR CORP.

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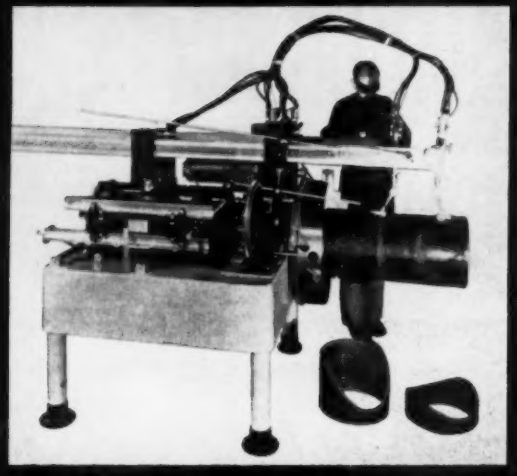
LOS ANGELES 63, CALIFORNIA

CABLE: CLICONI LOS ANGELES

NOW CONTOUR PIPE WITHOUT CAMS OR TEMPLATES

..with "THE MECHANICAL DRAFTSMAN"



Model 624 shown making 30° contour cut and straight cut-off simultaneously on 16" pipe.

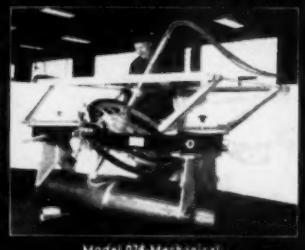
Available in 3 models for various pipe sizes.

May be equipped with Heliarc for cutting of Aluminum, Stainless, Copper, etc.

"The MECHANICAL DRAFTSMAN" makes accurate, slag-free cuts . . . *ready for welding . . . automatically.*

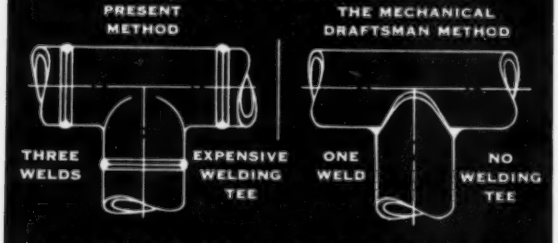
"THE MECHANICAL HOLE CUTTER"

Cuts a perfect hole to match the contoured end cut made by The MECHANICAL DRAFTSMAN. Will cut circles and ellipses in flat plate, as well as perpendicular or angular holes in pipe and tank shells. Available in 3 Models to cut holes to 24" diameter.



Model 024 Mechanical Hole Cutter

PIPE JOINT METHODS



Specify "The MECHANICAL DRAFTSMAN" machine cut joints. Elimination of welding fittings and reduction in cutting, fitting and welding time in piping installations results in material and labor savings as high as 75%.

STEFFAN MANUFACTURING CORP.
SALEM, OHIO

WHO'S WHAT

Continued

▸ *DUNHAM-BUSH, INC.*—Robert W. Steurer, industrial representative in Washington, D. C., area; R. G. Morey, industrial automotive representative in Florida; H. G. Bemis, sales engineer in St. Louis area; John A. Krisch, sales engineer in Philadelphia area; Paul W. Crawley, Jr., sales engineer in northeast district; Herbert Tinning, sales engineer in New Jersey; Stanley A. Brickman, application engineer in New York district office; Donald E. Kittredge, application engineer in San Francisco office.

▸ *MUELLER BRASS CO.*—Lawrence Faust, district manager of Kansas City, Mo., sales territory; William Osier, district manager of Des Moines, Iowa sales territory; William R. O'Reilly, district manager of Dallas sales territory; Joseph G. Strafella, sales representative in Syracuse, N. Y., office; K. James Lamlein, sales representative in Cleveland office.

▸ *YORK-SHIPLEY, INC.*—R. J. Heiting, sales representative for Jackson & Church, Chicago area division.

▸ *STERLING, INC.*—Ralph C. Frey, sales representative for northern Ohio territory; Charles M. Colyer, representative in South Carolina.

▸ *RECOLD CORP.*—Ralph H. Stebbings, new partner in manufacturer's representative firm of Hanson & Stebbings Co., Miami, Fla.

▸ *VIKING AIR PRODUCTS DIV., NATIONAL-U. S. RADIATOR CORP.*—William D. Bogh, factory representative for southern California and Arizona; L. M. Silva, factory representative for northern California.

▸ *PHILIP CAREY MFG. CO.*—N. D. Musser, sales manager of Dallas district, covering states of Louisiana, New Mexico, Oklahoma, Texas.

▸ *CONTROLS CO. OF AMERICA*—Watson Electric Supply Co., Dallas, distributor.

▸ *W. D. ALLEN MFG. CO.*—Stickler & Downs, Inc., Milwaukee, sales representative in most of Wisconsin and Upper Michigan Peninsula; A. C. Bjerken & Associates, St. Paul, representative for Minnesota, Iowa, North Dakota; A. F. Becker, St. Louis, representative for Missouri, Kansas, southern Illinois.

▸ *ALADDIN HEATING CORP.*—A. J. Bouey, sales representative for northern California.

WHO'S WHAT

Continued

▶ *OPW CORP., DIV. of JORDAN CORP.*—Michael J. Madden, west coast district manager; P. H. Coleman, Cincinnati region sales manager.

▶ *PARKER SEAL CO., DIV. of PARKER HANNIFIN CORP.*—Hercules Packing Corp., distributor of company's "Gask-O-Seal" line.

▶ *ALPHA PLASTICS INC.*—Sales Service Corp., Sarasota, Fla., sales representative.

▶ *PEERLESS HEATING CO.*—Peterson-Contarsy, representative for most of southern California and part of Nevada; Hicks & Theisen, Inc., representative for Wisconsin.

▶ *DRAYER-HANSON*—Howard Crusey, sales engineer, in charge of sales agent groups in certain western territories; General Equipment Co., Sopkane, Wash., sales representative in eastern Washington, northern Idaho, western Montana.

▶ *ARKLA AIR CONDITIONING CORP.*—Charley Lockhart, associate for water chiller equipment in Texas.

▶ *L. E. PELLETIER AND ASSOCIATES*—Kenneth F. Pelletier, representative.

▶ *DRESSER MFG. DIV., DRESSER INDUSTRIES, INC.*—Edwin O. Stafford, west coast regional sales manager.

▶ *HARDESTY-FAVERO & CO., INC.*—Merrick R. Mohr, representative.

▶ *DAYTON RUBBER CO.*—Joseph B. Maxson, regional manager of central region with headquarters in Dayton; new warehouse and regional sales office located at 7726 Reinhold Dr., Cincinnati.

▶ *C. H. WHEELER MFG. CO.*—William D. Nelson, sales engineer in New York sales office.

▶ *ANSUL CHEMICAL CO.*—Richard S. Dawson Co., Los Angeles, sales representative.

▶ *DEMING CO.*—J. A. Monahan, district representative for Nebraska, Kansas, Iowa, part of Missouri; Carloss Pump Co., Memphis, distributor.

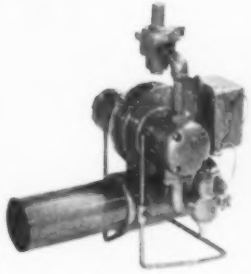
LARGE OR SMALL

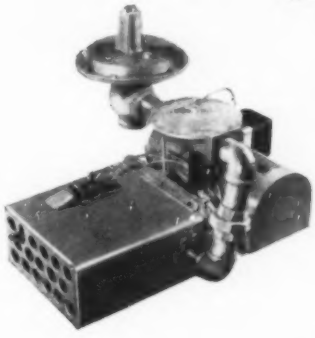
LO-BLAST

POWER GAS BURNERS

SAVE MONEY

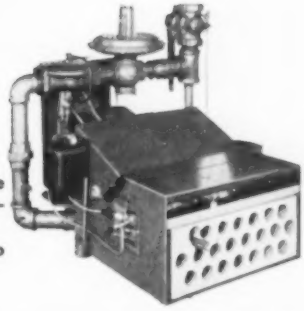
THE *ECONOMITE*
FOR RESIDENTIAL INSTALLATIONS
Capacities from 75,000 to 700,000 BTU/hr. input.





THE STANDARD Lo-BLAST
Capacities from 100,000 to 20,000,000 BTU/hr. input.

THE DUAL FUEL Lo-BLAST
The finest gas burner...the finest oil burner now combined in one great unit.
Capacities from 600,000 to 2,500,000 BTU/hr. input.



AVERAGE 10% LESS IN OPERATING COST

Lo-BLAST Power Gas Burners save money because they eliminate the fuel waste caused by uncontrolled draft.

When a *power type* burner shuts off, there is no rush of draft air to carry heat up the chimney, a condition which would cause a serious fuel waste. The Lo-BLAST Burner does not depend upon natural draft, but upon air supplied by a small *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, the flow of air shuts off. The heating plant thus retains much of its heat between operations.

That's why Lo-BLAST Burners cost substantially less to operate.

SEND TODAY FOR COMPLETE INFORMATION

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

How to simplify air conditioning system water treatment

Here's servicing of air conditioner water in the easiest possible way. A routine 10 minute daily check by one man, and Oakite Airefiner No. 52 ... that's all it takes. You end scale, slime, algae and corrosion troubles. You avoid out-of-service time, and maintain cooling efficiency.

The entire operation is simplicity itself. (1) Charge water initially with economical Oakite Airefiner No. 52. (2) A simple once-a-day check of water tells whether any adjustment is needed. (3) Add upkeep, if necessary. (4) Periodically, drain system and replenish with fresh, charged water.

Oakite Airefiner No. 52 leaves no deposit on tubes, is safe, and costs little for initial charge as well as upkeep.

Call in the local Oakite Technical Service Representative to get details and drawings on this money- and trouble-saving procedure. Or write Oakite Products, Inc., 32D Rector Street, New York 6, N. Y.

OAKITE

Export Division
Cable Address: Oakite

specialized
WATER TREATING
materials

Technical Service Representatives in Principal Cities of U. S. and Canada

WHO'S WHAT

Continued

▸ *TRANE CO.*—Kenneth Mirov, assistant manager of San Francisco sales office; David L. Canfield, sales engineer in Detroit sales office; Ian M. Dennis, sales engineer in Newark, N. J., sales office.

▸ *BALTIMORE AIRCOIL CO., INC.*—William P. Tennity of Tennity & Co., Inc., Los Angeles, sales representative.

▸ *JONES & LAUGHLIN STEEL CORP.*—Branchland Pipe and Supply Co., Huntington, W. Va., distributor for company's standard and line pipe.

▸ *BINKS MFG. CO.*—William Krusen, sales representative for Kansas City territory; Thomas Frederick and Harry Boult, sales representatives for Dallas branch; Henry Glass, sales representative for Philadelphia branch; Robert Muessig, sales representative for New Jersey area with headquarters in New York City.

▸ *ILG ELECTRIC VENTILATING CO.*—Stanton W. Smith, Milwaukee sales office manager; A. K. Johnson, Cleveland manager.

▸ *ATLAS VALVE CO.*—Erskine Engineering Products Co., Chicago representative; Controlamatic, Pittsburgh representative.

▸ *BUENSOD-STACEY, INC.*—New representatives include: Busch Co., Pittsburgh; Albert Weiss Air Conditioning Products, Inc., New York; Lewis Reid Co., Syracuse, N. Y.

▸ *WILKERSON CORP.*—Canal Pipe and Supply Co., Seattle, distributor in western and central Washington.

▸ *BAILEY METER CO.*—New Jersey sales office opened at 110 Halsted St., East Orange; Pittsburgh district office moved to 875 Greentree Rd., Pittsburgh 20; R. T. Keller, resident engineer moved to 1143 Mary St., Jacksonville 7, Fla.

▸ *ACME INDUSTRIES, INC.*—New direct factory sales office opened at 1485 Bayshore Blvd., San Francisco 24.

▸ *WOLVERINE TUBE, DIV. of CALUMET & HECLA, INC.*—Bruce C. Doering, sales representative in Cleveland district.

WHO'S WHAT

Continued

▸ *CRANE CO.*—New company sales zones and their managers: northeastern zone, New York City, E. B. Franklin; southeastern zone, Atlanta, M. F. Du Chateau; central zone, Chicago, Harold H. Stift; southwestern zone, Dallas, R. G. Hunter; western zone, Los Angeles, R. F. Parsons.

▸ *PITTSBURGH COKE & CHEMICAL CO., PROTECTIVE COATINGS DIV.*—John E. Himmelrich, eastern regional sales manager.

▸ *HENRY PRATT CO.*—Arthur B. Openshaw, Jr., representative for direct sales of manufactured equipment in Chicago area.

▸ *CENTURY ELECTRIC CO.*—New branch office locations: Chicago, 6835 W. Higgins Rd., Chicago 31; Richmond, 3318 W. Carey St., Richmond, Va.; Davenport, 201 Plaza Bldg., 1821 State St., Bettendorf, Iowa.

▸ *MARLO COIL CO.*—Sterling & Newby, Dallas, sales agents; McCombs Supply Co., Denver, sales representative.

▸ *McQUAY, INC.*—Richard K. Peck, Jr., Tampa, Fla., sales representative.

▸ *JAMESBURY CORP.*—Charles A. Richardson, sales representative for New England area; W. G. Hurd, southeastern district manager with headquarters in Atlanta, Ga.

▸ *INLAND STEEL PRODUCTS CO., COMMODITY PRODUCTS DIV.*—Richard M. Wille, Milwaukee branch manager; Lloyd G. Rode, Minneapolis branch manager.

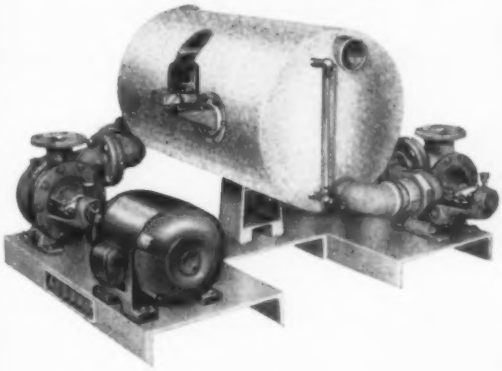
▸ *RITTLING CORP.*—Breitenbach, Whitmoyer, Sheehan Co., Bala Cynwyd, Pa., sales representative for Philadelphia area.

▸ *A. M. BYERS CO.*—G. C. Kimbrough, field service engineer in Atlanta division office; Douglas F. Williams, manager of new sales office in Richmond, Va.; Southland Supply Co., Dallas, distributor of company's PVC pipe; W. M. Pattison, Cleveland, distributor of company's PVC pipe.

▸ *SOLAR AIRCRAFT CO.*—Control & Steam Equipment Co., Seattle, sales representative; Huson Sales & Engineering Co., Spokane, Wash., sales representative.

HANDLES HOT WATER PERFECTLY

Will not vapor bind...or lock!



AURORA® APCO

HORIZONTAL CONDENSATION RETURN UNITS

These horizontal units are used wherever the returns are above the boiler room floor level. Because these Aurora turbine-type pumps are capable of pumping condensate returns with entrained vapor, they positively will not vapor bind. The free-running clearance of Aurora Apco's one moving part, the impeller, means that expansion due to heat does not cause metal-to-metal contact.

The suction equally distributes hydraulic pressure to both sides of the multi-vaned impeller, eliminating end thrust. These Aurora Apco units automatically adjust to varying capacity and pressure conditions.

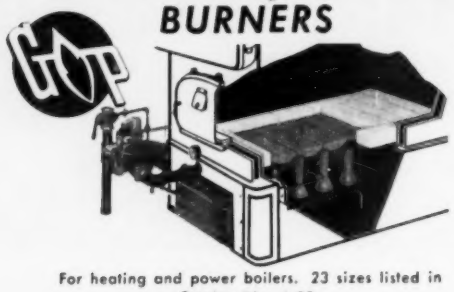
AURORA Always PUMPS

FOR MORE COMPLETE DATA, WRITE FOR BULLETIN H-113.

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
650 LOUCKS ST. AURORA • ILLINOIS

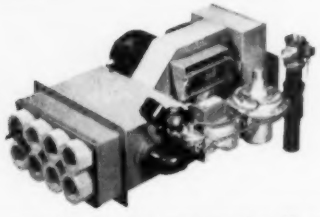
"Planned Performance"*

BURNERS



For heating and power boilers. 23 sizes listed in Catalog No. A-10.

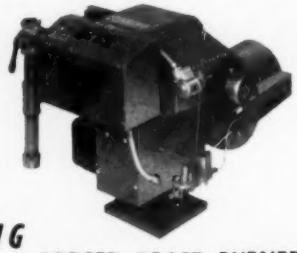
BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



Fully automatic, packaged assembly. Sizes listed to 28 million BTU/HR in Catalog C-10

TURBO-FIRE POWER TYPE GAS BURNER

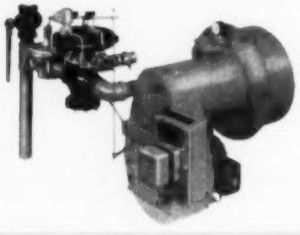
MODEL R
Capacities up to
2¼ million BTU/HR
Catalog E-61



TURBO-RING FORCED DRAFT BURNERS

Gas, oil, or combination Gas-Oil burner. No stack required on boilers equipped for pressure firing.

MODEL FGR
Capacities 1 to 9
million BTU/HR
Catalog E-51



* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt

P. O. Box 914
Winfield, Kansas

WHO'S WHAT

Continued

▸ *NATIONAL SUPPLY CO., TUBULAR DIV.*—Richard S. Skinner, district manager in Philadelphia.

▸ *OLIPHANT COMMERCIAL CORP.*—Now located at new quarters at 1287 66th St., Emeryville 8, Calif.

▸ *CONSOLIDATED PIPE CO. OF AMERICA*—New representatives for "Copcoa" line of pipe, pipe fittings include: Chester Bess Co., Buffalo, N. Y.; Loftus-Shoenberger, Cincinnati; Howard Bond, Birmingham, Mich.; Robert J. Kruse Co., Indianapolis.

▸ *KENISCO TUBE CO.*—John D. Heider, Wisconsin sales representative; Ryder Pratt and Associates, St. Louis, tri-state district representative.

▸ *J. E. LONERGAN CO.*—Hajoca Corp., Richmond, Va., wholesale distributors; National Industrial Supply Co., Harrison, N. J., distributor.

▸ *STRUTHERS WELLS CORP., TITUSVILLE IRON WORKS DIV.*—New divisional sales managers and their districts: J. W. Pike, eastern sales division, extending from Maine to Virginia and including eastern areas of New York and Pennsylvania; H. E. Dodge, northern sales division, running east of Mason-Dixon line to Virginia border and including upper New York and western Pennsylvania; K. J. Howard, southern sales division, south of Mason-Dixon line and including Arkansas, Oklahoma and Texas; J. L. Dowd, western sales division, including all states west of the Mississippi.

▸ *STODDARD INDUSTRIES*—William J. Eastman, representative for Wisconsin.

▸ *WARREN PUMPS, INC.*—Shoemaker Engineering Co., Beverly Hills, Calif., industrial sales representative in Los Angeles area; John H. Marvin Co., Inc., Portland, Ore., sales representative in Washington and Oregon.

▸ *YORK CORP., DIV. of BORG-WARNER*—Richard M. Boyer, field engineer for York-Detroit Wholesalers.

▸ *AMERICAN AIR FILTER CO., INC.*—R. M. Toucey, exclusive representative in Pittsburgh area for Herman Nelson products; Associated Thermal Products, Inc., New York, to handle all of company's products; Don F. Moran, New York director for school air systems sales; William J. Rudy, director of New York City industrial sales; C. J. Gaspar, manager of New York City branch office. ‡

WE HEAR THAT...

▸ *FRED S. DUBIN ASSOCIATES* recently opened a consulting engineering office in San Juan, Puerto Rico, with Victor M. Garcia in charge.

▸ *HUPP CORP.* has purchased the valve operator division of *CUTLER-HAMMER, INC.* The acquisition includes tools, fixtures and inventory. Manufacturing operations will be moved from Milwaukee to the purchasing company's Chicago plant.

▸ *MAX-ARNOLD CO.* recently held an open house attended by 600 Philadelphia area architects, engineers, contractors, and heating piping and air conditioning wholesalers at its new quarters in that city. The new, one story, brick building provides 13,000 sq ft of office and warehouse space, and is located at 2201 W. Glenwood Ave., Philadelphia.

▸ In a new expansion move, *POSEN & KLINE TUBE CO.*, a subsidiary of *HANDY & HARMAN*, has added 80 percent to its plant area, and has doubled production capacity.

▸ *AUTOMATIC CONTROL CO.* has announced its expansion into the original equipment market on component parts and sub-assemblies for liquid and pressure controls.

▸ *AIR REDUCTION PACIFIC CO., DIV.* of *AIR REDUCTION CO., INC.*, has begun construction of a new $3 million liquid oxygen, nitrogen and argon plant in Richmond, Calif. The new plant will produce 30 tons of the liquid products daily.

▸ *SURFACE COMBUSTION CORP.* has announced a deferred payment finance plan to permit hospitals to acquire temperature and humidity control equipment on three-year terms.

▸ Stockholders of *WARREN WEBSTER & CO.* recently approved the sale of the company to *MANAGEMENT & DEVELOPMENT CORP.* The present company management will retain a substantial financial interest and will continue operation as before.

▸ Exhaustive tests by *ALUMINUM CO. OF AMERICA* indicate that a new zinc soldering technique offers an improved method for making sound, corrosion resistant soldered joints. The zinc soldering process is especially suited to bonding thin complex sections, including heat exchangers of all types.

Reed®
INDUSTRIAL FANS
TOP QUALITY PERFORMANCE

POWER ROOF VENTILATORS

MUSHROOM TYPE
DIRECT AND BELT DRIVE

Blade diameters from 12 in. to 60 in. • Static Pressures up to one inch water gauge • Air capacities to 50,000 CFM • Fan section insulated from housing • Ball bearings throughout • Hood can be raised from either end • Truly reversible air flow with equal performance in either direction also available.

new low silhouette

All Reed products are top quality, heavily constructed and built for a lifetime of heavy duty. No riveting is used, but electro - weld and interlocking seam construction throughout.

TUBEAXIAL FANS

DIRECT DRIVE
AND BELT DRIVE

Wide range of air deliveries up to 76,000 CFM and static pressures to 6 inch W.G., tailormade to your air moving problems. 9 to 60 inch diameters, 2 to 13 blades, heavy all-welded construction. Special finishes available.

REED UNIT-FANS, INC.
501 North St. Patrick Street • New Orleans 19, La.
25 Years of Quality Fan Construction
Member Air Moving and Conditioning Assn, Inc. (AMCA)

WE HEAR THAT

Continued

▶ *SCHUTTE AND KOERTING CO.* has acquired a majority of the outstanding shares of *WHITLOCK MFG. CO.* The lines of the two companies will be integrated. No change in name, products, location or personnel is anticipated.

▶ *A. B. WICKS*, chief heating inspector for the City of Los Angeles, has been voted honorary membership in the *INSTITUTE OF HEATING AND AIR CONDITIONING INDUSTRIES, INC.* by its board of directors. The award was made in honor of his cooperation and service to the industry and community through the past years.

▶ *SIMEON MFG. CO.* is making its third move for expansion since 1949. The company's new building in Grandview, Mo., houses factory and laboratory facilities, as well as office space in an area of 20,000 sq ft.

▶ *INSTITUTE OF HEATING AND AIR CONDITIONING INDUSTRIES* honored *EL ROY PAYNE* of *E. L. PAYNE HEATING CO.* at a recent dinner in Los Angeles. He was awarded a special plaque and an honorary membership in the Industry for his contributions to the heating and air conditioning industry over the past 50 years.

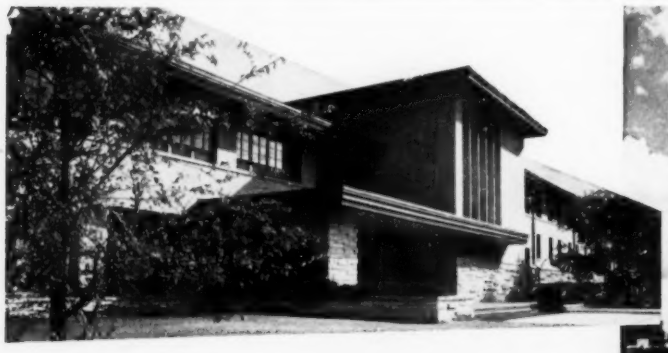
▶ *HAROLD A. LOCKHART*, vice president in charge of engineering for *BELL & GOSSETT CO.* was honored recently by the company for his 25 years of service at a special reception held at the company's plant in Morton Grove, Ill.

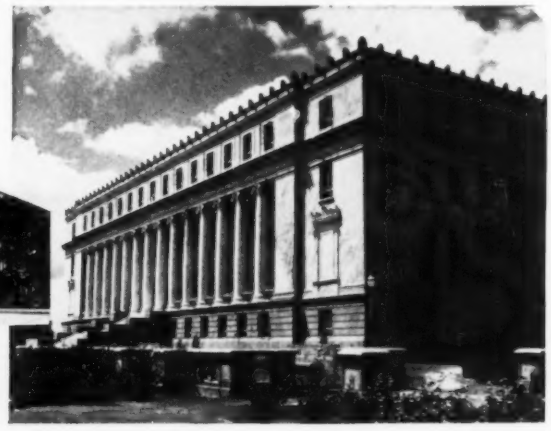
▶ *STANDARD STEEL CORP.* has concluded negotiations with *CARRIER CORP.* to acquire the assets of *CAMBRIDGE CO.* It has become an operating division of the purchasing firm.

▶ *HAROLD L. HUMES*, vice president and a director of *BALDWIN-HILL CO.*, has been selected 1959-60 president of *BUILDING RESEARCH INSTITUTE. ROBERT W. CUTLER*, general partner in the firm of *SKIDMORE, OWINGS & MERRILL* was named as the new vice president.

▶ A new plant, intended to consolidate operations now carried on at three separate locations for *TORIT MFG. CO.*, is now nearing completion. It will provide 45,000 sq ft of manufacturing and engineering space.

▶ *DAYTON RUBBER CO.* will soon begin production of "Poly-V" Power transmission belts as a result of an exclusive licensing arrangement with *RAY-*





AT TEXAS A&M

Thermal Engineering year around central plant and multizone air conditioners are in operation in the Administration Building*, the Library*, the Memorial Student Center*, and the U. S. Dept. of Agriculture facility* at the Agricultural and Mechanical College of Texas. Many additional Thermal units are presently to be installed in the new Chemistry Building**.

*Hollis U. Bible, Consulting Engineer, Houston, Texas

**Bernard Johnson & Associates, Consulting Engineers, Houston, Texas

Thermal Engineering manufactures a complete line of central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. Write for complete information and a list of satisfied users.

Manufacturers' Agents . . .
territories open in certain areas . . . write us.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

WE HEAR THAT

Continued

BESTOS-MANHATTAN, INC. The latter company will also continue to manufacture the product and will distribute it through its own sales organization.

▸ *CERRO de PASCO CORP.* recently announced completion of basic engineering studies for the improvement of facilities of the Monsanto, Ill., copper and brass tube mill of its *LEWIN-MATHES CO.* division. The program is to be started this year, and completed during 1961. Construction of a new copper tube mill at Newark, Calif., is also being planned.

▸ Construction of a new general office building in Chicago has been announced by *JOSEPH T. RYERSON, INC.* The two-story building will be located adjacent to the company's plant at 16th and Rockwell Sts. Completion is scheduled for late in 1960.

▸ Negotiations for the opening of two new plants overseas have been completed by *GIBRALTAR CO. OF AMERICA.* The plants located in Hong Kong, China and Osaka, Japan, will be operated as a separate division to accommodate European and Oriental markets.

▸ *HOOKER CHEMICAL CORP.*'s newly completed research center at Grand Island, N. Y., was recently dedicated in ceremonies at which governor Nelson A. Rockefeller presided. The new facility represents an investment of $3,600,000.

▸ An estimated 500 engineers attended the recent 43rd annual convention of the Florida Engineering Society. Among the speakers at the convention, *HARLAND E. REX*, application engineer of *CARRIER CORP.* discussed the use of the heat pump in heating large commercial buildings.

▸ *WEKSLER INSTRUMENTS CORP.*, honored three of its executives at a recent testimonial dinner. The three 25 year veterans lauded for their service were *HARRY WEKSLER*, chairman of the board, *JOSEPH BAKOFIN*, vice president in charge of production, and *FRANK J. PLA*, vice president in charge of sales.

▸ *MacKENZIE WALTON CORP.*, a wholly owned subsidiary of *READING TUBE CORP.* is currently celebrating its 50th anniversary.

▸ In keeping with its new expansion program, *HENRY PRATT CO.* has moved its main office to larger quarters at 319 W. Van Buren St., Chicago.

For assistance on your pumping problems . . .

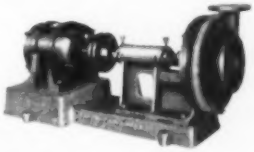
Call any AMERICAN-MARSH Representative!

IN 64 LOCATIONS, your nearby American-Marsh Representative is ready, willing and able to assist you in solving pumping problems. Call him for suggestions today—or any day he can serve you!

Alabama: Birmingham
Arizona: Phoenix
Arkansas: Little Rock
California: Los Angeles
San Francisco
Colorado: Denver
Connecticut: South Kent
Florida: Jacksonville
Illinois: Chicago
Indiana: Fort Wayne
Indianapolis
Iowa: Des Moines
Kentucky: Louisville
Louisiana: New Orleans
Maine: Portland
Maryland: Hyattsville
Massachusetts: Boston

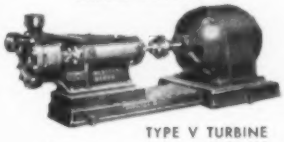
JR. REDI-RETURN Bul. 425

North Carolina: Charlotte
Greensboro
Ohio: Cincinnati
Cleveland
Toledo
Youngstown
Oklahoma: Oklahoma City
Tulsa
Oregon: Portland
Pennsylvania: Erie
Harrisburg
Philadelphia
Pittsburgh
South Carolina: Greenville
Tennessee: Knoxville
Memphis
Nashville
Texas: Corpus Christi
Crystal City
Dallas
Harlingen
Houston
San Antonio
Waco
Utah: Salt Lake City
Virginia: Richmond
Washington: Seattle
West Virginia: Charleston
Ontario: Stratford
Quebec: Montreal



RDM END SUCTION Bul. 300

Michigan: Battle Creek
Detroit
Grand Rapids
Kalamazoo
Lansing
Saginaw
Minnesota: Minneapolis
Missouri: Kansas City
St. Louis
Montana: Billings
Nebraska: Omaha
New Jersey: Tenafly
New Mexico: Albuquerque
New York: Buffalo
Cohoes
New York
Syracuse



TYPE V TURBINE Bul. 450

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

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Pumps and Pumps only Since 1873
CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR PROCESSING, AIR CONDITIONING, BOILER FEED, TESTING, ETC.

Reduce costs up to 75% by bending..

TAL BENDERS by HEIN-WERNER MAKE SMOOTH, UNIFORM BENDS WITHOUT DISTORTION!

Take a tip from other contractors – choose a Hein-Werner Tal Bender to save up to 75% of time and labor costs. Bending is *the practical* way to reduce cost of cutting and threading or welding fittings. And, Hein-Werner Tal Benders are simple to operate and *easy to handle* – one frame and one setting bends material cold without shifting or resetting. You choose the right set or combination that's best for you to bend pipe and conduit in diameters from ⅜" to 8". Learn how you can slash material and assembling costs by bending – write for catalog No. 35 that shows the many exclusive features offered by Hein-Werner, or see your plumbing and heating wholesaler for full information.

Hein-Werner CORPORATION
WAUKESHA, WISCONSIN

WE HEAR THAT

Continued

▸ *AMES IRON WORKS, INC.* announced its new expansion program at its annual meeting of stockholders and directors held recently in Oswego, N. Y. New products now in planning or production stage will be factors in the development operations.

▸ *MIDWEST PIPING CO., INC.* has purchased the physical assets of two *SPARTON CORP.* subsidiaries, *FLORI PIPE CO.*, and *HOUSTON PIPE & STEEL, INC.* The purchase is the initial step in the company's expansion to nationwide operation.

▸ *DAYTON RUBBER CO.* has formed a new company in Chicago to handle its line of products. The new company, known as *DAYTON INDUSTRIAL PRODUCTS CO.*, will be located in a building now under construction in Melrose Park, west of the city.

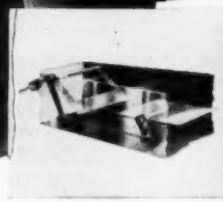
▸ As part of its product and market expansion program, *KEASBEY & MATTISON CO.* has formed a new products department, which will carry new products through from the idea to the marketing stage. The new department is headed by *J. R. MacMASTER.* ≠

Coal *has always been dependable* now it can be automatic

Will - Burt Hopper and Bin Feed Model Stokers — capacities, 150 through 750 lbs. per hr.

A Will-Burt coal heat installation will *bring coal from bin to stoker . . . feed the necessary coal at any of three adjustable rates . . . and automatically adjust air supply minute by minute, to fuel bed needs.* Panel controls by Will-Burt will *automatically cycle one stoker, or several.*

What could be more practical — especially when you consider the known economy and safety of coal fired heat?



W-B Automatic Air Control — sensitively controls air supply — prevents excessive soot or smoke.

W-B Coal Conveyor — practical for any installation — operates at any angle — single, dual, or cross feed tandem.

W-B Panel Controls — make scheduled heating a simplified, supervisory operation — tailored to the job.

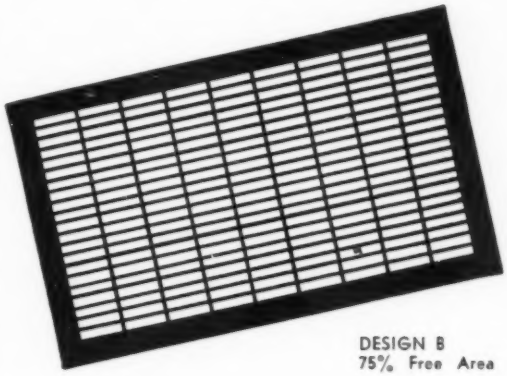
WILL-BURT STOKER

WILL-BURT STOKERS
Box 902 ORRVILLE, OHIO

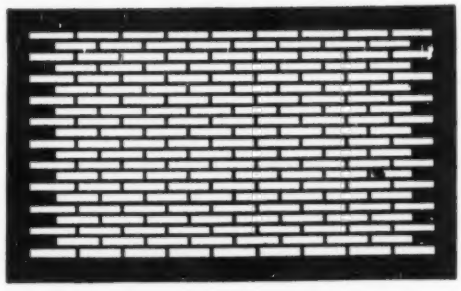
A-J

Architectural Grilles

for every type of installation

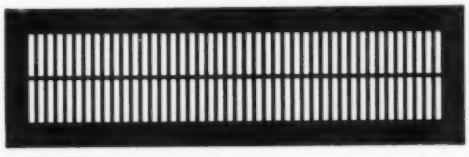


DESIGN B
75% Free Area



DESIGN C
73% Free Area

Getting exactly what you want is no problem when you specify A-J Architectural Grilles. There are practically no limitations on size and grilles can be made to your exact order from steel, aluminum, bronze, monel or stainless. Available in slotted designs B, C, and D, and square meshes of ½", ⅝", ¾" and ⅞". Send for FREE A-J catalog that contains complete specifications.



NEW FROM A-J! Design E Convector-type grille with vertical slots for cooling or heating outlets, return or exhaust application. Free area 54%. May be installed in sills, sidewalls, ceilings or floors. Available in steel, aluminum, stainless or bronze.

A-J MANUFACTURING CO.

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Obituaries

Louis L. Narowetz

LOUIS L. NAROWETZ, 67, president of the Narowetz Heating and Ventilating Co., Chicago, died May 27, 1959, as the result of a fall from a building. Mr. Narowetz was very well known in the industry. He had been an active member of the Sheet Metal and Air Conditioning Contractors' National Association during the association's early days and up to the present time. Mr. Narowetz was in the process of turning his firm over to its employees at the time of his death. He is survived by his wife and three daughters.

Alton Frank Davis

ALTON FRANK DAVIS, vice president and secretary of the Lincoln Electric Co., died recently at the age of 69 in his home in Shaker Heights, Ohio. He had been in failing health for several months. Following his graduation from Ohio State University, Mr. Davis was hired by the Lincoln firm as a salesman; he subsequently channeled his work to public relations and advertising for the company. In 1925 he was made a director and vice president, and became secretary in 1938. Alton F. Davis was a member of the American Welding Society, and in 1945 inaugurated the A. F. Davis Welding Awards given by that organization. Other organizations with which he was associated include, the American Society for Engineering Education, American Society for Metals, and the American Society of Mechanical Engineers.

Leon T. Mart

LEON T. MART, chairman of the board of directors of the Marley Co., died recently at his home in Kansas City following a heart attack. He had just returned to his home after spending three months in California recuperating from an attack suffered while vacationing there. Mr. Mart formed the company in 1922, and was its president from that time until March 21, 1959, when he became board chairman. He held a number of inventions pertaining to water cooling towers, and was actively directing a comprehensive program of cooling tower research. Mr. Mart was a registered professional engineer, and was a Fellow of the American Society of Mechanical Engineers, and the American Society of Heating, Refrigerating and Air Conditioning Engineers. He held local offices in both groups.

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ALL TRAPS are NOT ALIKE

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Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.

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Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes Sterlco F & T's outstanding performers on unit heaters and other steam heating equipment.

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STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

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CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

MEETINGS & CONVENTIONS

1959

SEPT. 21-25—*Instrument Society of America*, instrument-automation conference and exhibit. International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

SEPT. 28-*OCT.* 1—*American Welding Society*, fall meeting. Sheraton-Cadillac Hotel, Detroit. American Welding Society, 33 W. 39th St., New York 18.

SEPT. 29-*OCT.* 1—*Western Region Conference of the National Association of Corrosion Engineers*, annual meeting. Bakersfield Inn, Bakersfield, Calif. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 5-7—*American Gas Association*, annual convention. Conrad Hilton Hotel, Chicago. American Gas Association, 420 Lexington Ave., New York 17.

OCT. 5-8—*Northeast Region Conference of the National Association of Corrosion Engineers*, annual meeting. Lord Baltimore Hotel, Baltimore, Md. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 20-22—*North Central Region Conference of the National Association of Corrosion Engineers*, annual meeting. Cleveland. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

NOV. 2-5—*Air Conditioning and Refrigeration Institute*, 11th exposition. Atlantic City Auditorium, Atlantic City, N. J. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

1960

FEB. 1-4—*2nd Southwest Heating and Air Conditioning Exposition.* Dallas. Under auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting, also in Dallas. Meetings to be held in the Baker and Adolphus Hotels; exposition to be held in Memorial Auditorium. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York. ‡

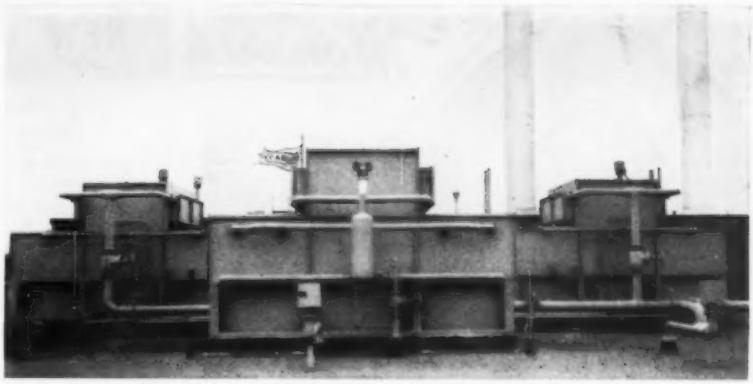
PLUG VALVE DATA

Engineers and contractors seeking facts on plug cocks and plug valves (both lubricated and nonlubricated) will find valuable information in the August issue of *Heating, Piping & Air Conditioning.*

Next month's Engineering Data File will be devoted to valves of this type. It will wrap up facts from many sources on points such as seating arrangements, operation, limitations, and applications.

This Data File is the latest in a series of permanent reference studies by HPAC on valves. Earlier studies covered Valves for Power and Process Piping and Globe and Gate Valves.

You can subscribe to HPAC in time to receive the August issue (or order earlier Data Files) by dropping a card to the circulation department. *Heating, Piping & Air Conditioning 6 N. Michigan, Chicago 2, Ill.*



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NIAGARA AEROPASS CONDENSERS give you trouble-free, automatic refrigeration at the least spread between head-pressure and suction pressure. You gain a great power saving. You also get removal of superheat before condensing, condensing at subcooled temperature and a refrigerant fully purged of oil. Out-door air takes up heat of condensation through evaporation of the least amount of water; low temperature condensing means freedom from scaling and loss of capacity. Niagara sectional design offers you lower costs for more compact equipment, easier to keep up. You get always full capacity, "new plant" efficiency and continuous savings such as 95% of condensing water cost that add to your profit. Managers who know their costs buy Niagara Aeropass Condensers.

Write for Bulletin 131

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Niagara District Engineers in Principal Cities of U. S. and Canada

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DUCTAPE

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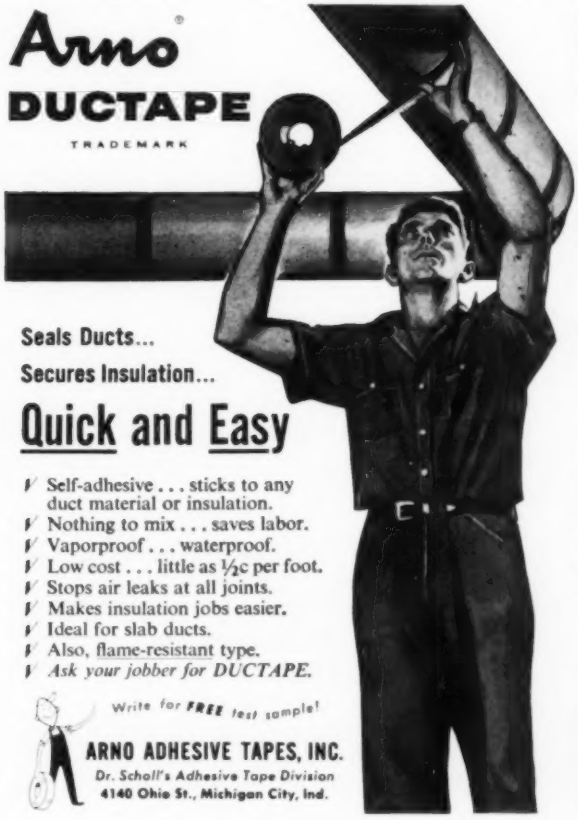

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Quick and Easy

- Self-adhesive . . . sticks to any duct material or insulation.
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GREENHECK *Air Movement Devices*

"C" Series

1959 "COLUMBUS" CENTRIFUGAL POWER ROOF EXHAUSTER

The clean solid lines of the new COLUMBUS direct drive (range from 75 to 22,000 CFM) centrifugal power roof exhausters are the first indications of the top quality materials and careful workmanship that make up each GREENHECK power ventilator. Non-overloading wheels, rubber vibration mountings, rugged ball bearing motors isolated from the exhausted air stream, and spun aluminum housings for lasting beauty provide top value. The companion BOSTON series belt drive units feature identical housings with an extended range (from 500 CFM to 4300 CFM). Write today for catalog 6-7 which gives complete engineering information.

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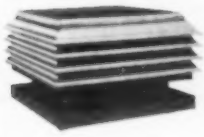
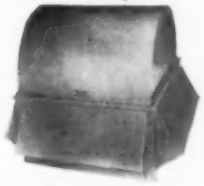


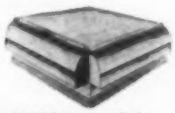
WAUSAU

Air Mover Belt drive centrifugal power roof exhauster. 300 CFM to 27,000 CFM range.



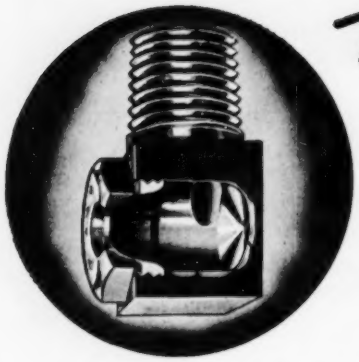
DALLAS

Air Mover Belt drive centrifugal power roof exhauster.



TUCSON Air Exhauster

Air mover provides low silhouette centrifugal roof exhauster — capacity 200 to 20,000 CFM.



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NOZZLES
for
AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from ⅛" to 1". ¼" size is 1-5/16" long and made from ⅝" square stock.

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3-WAY SOLENOID VALVE

for flow control of hot or chilled water with fan-coil units

This New addition to the J-E Line provides–

- **Economical temperature control.**
- **Separable solder flange for easy installation.**
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Write for information bulletin today.

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NEW BOOKS & REPORTS...

Cost Manual for Piping and Mechanical Construction—By Herbert Herkimer. 176 pp. Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10. $10.00.

Mechanical Estimating, Combined Volumes I and II—By Hugh C. Carter. California Technical Publications, 222 Atlantic Ave., Long Beach 2, Calif. $4.95.

Compilation of ASTM Standards on Steel Piping Materials. 524 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $6.00.

Elevated Temperature Properties of Cast Iron. 96 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $4.25.

Odor Measurement and Control. Proceedings of the Third Annual Symposium in Air Pollution. 82 pp. Franklin Institute Laboratories for Research and Development, 20th and Benjamin Franklin Pkwy., Philadelphia 3. $3.00.

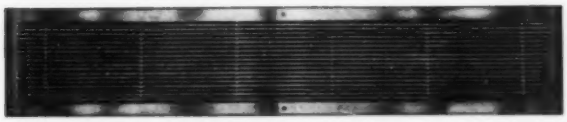
Transcripts of all papers presented at the First Australian Refrigeration and Air Conditioning Convention. 104 pp. Aircon Publications, 44 Castlereagh St., Sydney, Australia. $3.15 (25 shillings).

How to Increase Your Creative Output—Prepared by Deutsch and Schea, Inc., technical manpower consultants, Industrial Relations News, Book Dept., 230 W. 41st St., New York 36. $1.50.

Packaged Firetube Boiler Ratings. American Boiler & Affiliated Industries, Room 2502, 15 Park Row, New York 38. $1.00.

Pipes, Ducts and Fittings for Warm-Air Heating and Air-Conditioning Systems. Revision of Simplified Practice Recommendation R207-56. Edward J. McCamley, Commodity Standards Div., U. S. Dept. of Commerce, Washington 25, D. C.

Arc Welded Joints. 46 pp. National Electrical Manufacturers Association, Arc Welding Section, 155 E. 44th St., New York 17.



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FOR MODERN PUBLIC BUILDINGS

Heating Engineers asked for a stronger, more durable grille — in harmony with the modern trend toward maintenance-free construction through greater use of Aluminum and Steel. Here's our answer: a Custom-Built Heavy-Duty Bar-Type Grille that provides long-needed protection against the trouble and expense so often caused by replacement of ordinary light-gauge grilles.
Available in any desired size or shape — All Steel or All Aluminum — for straight or deflected air flow. Bulletin 43 gives complete information. Write for free copy.

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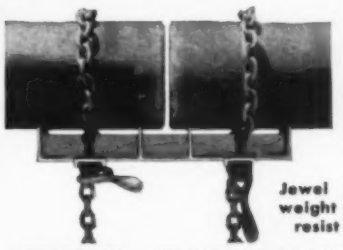
Manufacturers, also, of DIAMONTEX, the Perforated Metal Lay-in Panel for modern acoustical ceilings. Ask for Bulletin 47

Jewel PIPE WELDING Clamps



CLAMPS FOR WELDING PIPE • FLANGES • ELBOWS • ANGLES —also PIPE MARKERS

These Clamps align the pipe perfectly, and hold it there until it is welded. Two sizes, ½" to 8"; 8" to 16"

Jewel Pipe Clamps are lightweight — rigidly constructed — resist strain, heat and abuse.

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AIR or ELECTRIC IMPACT WRENCHES

• Remove compressor heads • Break a compressor all the way down • Fabricate piping systems • Bolt flanges, elbows and ties • Service traps and valves • Spin nuts and bolts on and off wherever they are.

Call your nearest SIOUX distributor, or write . . .
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Loosens Rust and Corrosion
Quickly frees 'frozen' parts!

LIQUID WRENCH
The Super-penetrating Rust Solvent

powerful blend of fast-acting solvents that literally "melts the rust away"

Works FAST! At your wholesaler!

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Rates for classified advertising are 15 cents for each word including heading and address. One inch $7.00. Count nine words for keyed address. Minimum $2.50 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.

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Mechanical Engineer, plumbing, heating, air conditioning and process piping. Thoroughly experienced estimating, specification writing, purchasing and contract negotiation. Age 39; desires contractor's office, consultant or with manufacturer. Prefer New York City, but will consider good opportunity elsewhere. Address Key 1414A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SITUATION OPEN

Mechanical Engineer, graduate, experienced on design of industrial power plant work, heating, air conditioning, piping. Large firm of architects and engineers. Real opportunity. Located in outstate Michigan. Address Key 1413A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

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An established manufacturer with 25 years experience, producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans.
The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators. Please reply Key 1361A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

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IDENTIFICATION NAME PLATES for controls and panels — precision engraved on bakelite or black anodized alum. — any titles — quick service by mail on small and large jobs — send for sample and prices. ATLANTIC ENGRAVERS, INC., 232 Ocean Ave., Amityville, N. Y.

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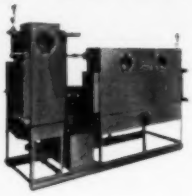
You'll get it quicker if your postal delivery zone number is on the order blank, return envelopes, letterheads.

The Post Office has divided 106 cities into postal delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include *your* zone number in *your* return address — after the city, before the state.

KATHABAR® SYSTEMS

Give these advantages to specifying engineers:



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Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to deliver air at 5 micro-organisms per 10 cu. ft. or less, continuously.

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Permanently stop condensation on walls, floors, products. Dry up exposed water (bacteria breeding ground) no matter what your dry bulb. Results proved (you check) almost anywhere: foods... chemicals...waterworks... cargo ships...even caves! Name your required conditions (grains/pound and dry bulb) for process, storage, testing: Kathabar systems deliver.

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name & title.....

company.....

street.....

city.....*zone*.....*state*.....

Surface

59-1E

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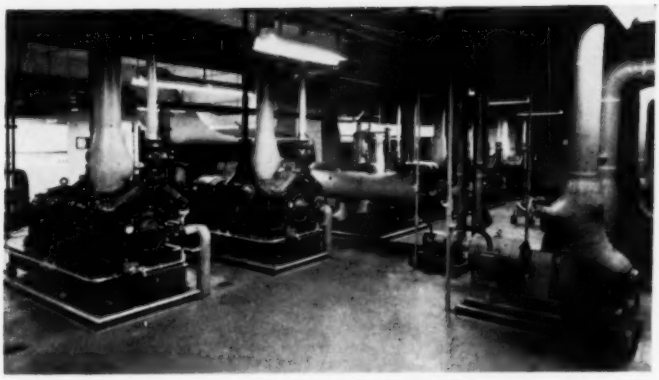
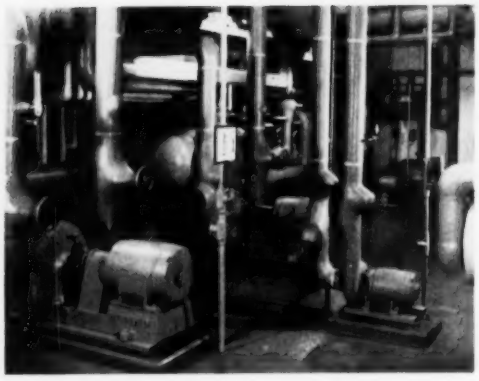


Six 100 h.p. compressors (2 separate systems of 3 compressors each) are used in main heat pump for Columbus and Southern Ohio Electric Co. building. Heat pump was built and installed by York Division, Borg-Warner Corporation, York, Pa. This big installation uses 12 Weinman centrifugal pumps.



Weinman Type L-1 pumps (left) circulate hot and chilled water through air-handling system for Columbus and Southern Ohio Electric Co. building. Pumps are insulated to keep condensate off floor. Smaller Type K Unipump (right) pumps cooling water to IBM room the year 'round.

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THERMO-FILM* —the safety barrier heat transfer liquid—is extremely thin to maintain maximum heat transfer.

EXTENDED SURFACE of outer tubes substantially reduces size and weight of heater.

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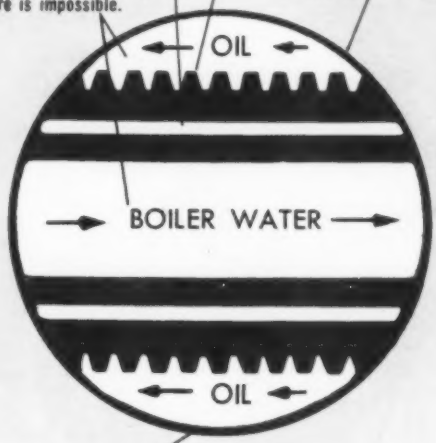
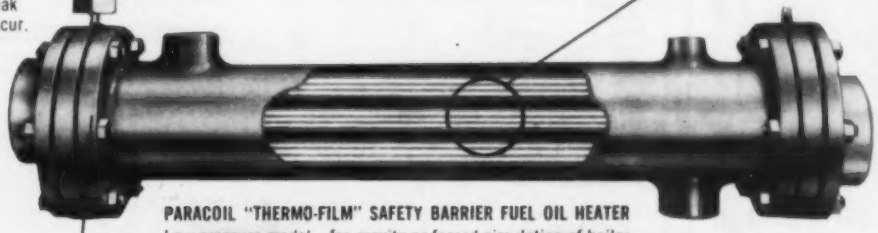


This Paracoil Thermo-Film* fuel oil heater permits direct use of boiler water and fuel oil in the same shell. Design safely isolates oil and water circuits. Oil leak cannot contaminate boiler stream. This diagram explains the heater's remarkable efficiency.

IMPROVED INDICATOR immediately reveals presence of oil in heat transfer liquid in the unlikely event a leak should occur.



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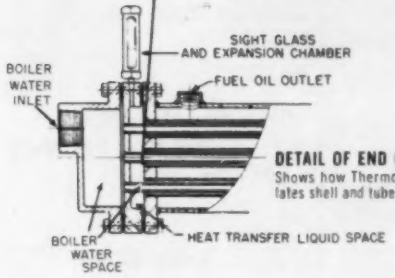
Low pressure model—for gravity or forced circulation of boiler water. Provides maximum capacity with minimum size. Also available but not shown: high pressure models, for use with high temperature hot water or steam as the heating medium.



DETAIL OF END CHAMBER
Shows how Thermo-Film* isolates shell and tube side fluids.

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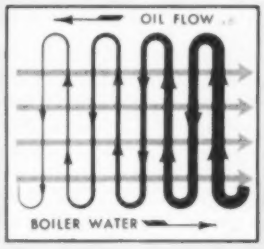
Oil, with low pressure loss, passes in baffled flow across heating tubes — further increasing heat transfer rates and reducing bulk of the heater. (Thickness of oil flow line represents viscosity).



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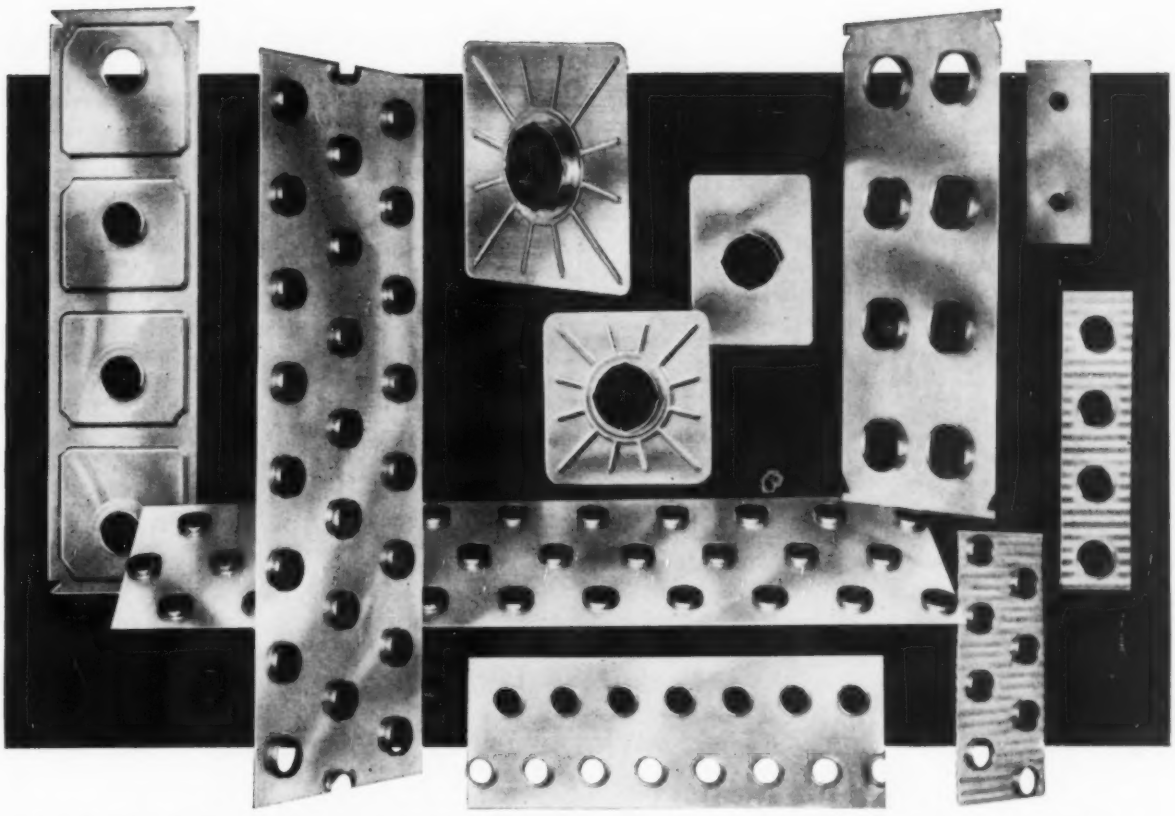

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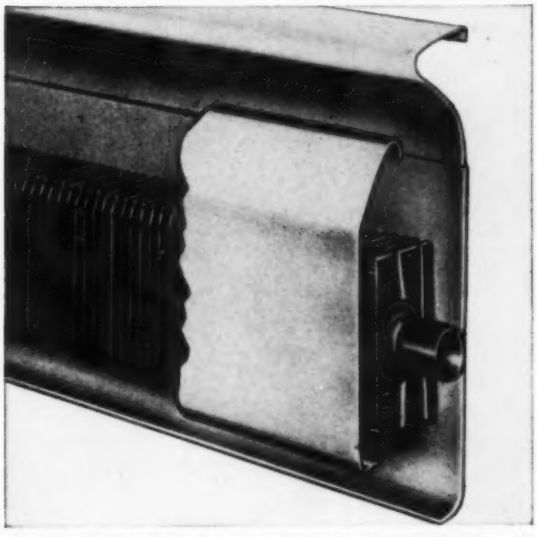

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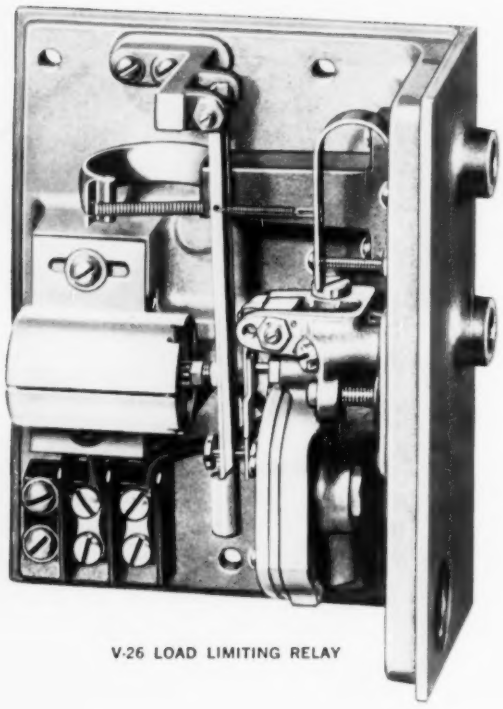
NEW JOHNSON V-26 LOAD LIMITING RELAY

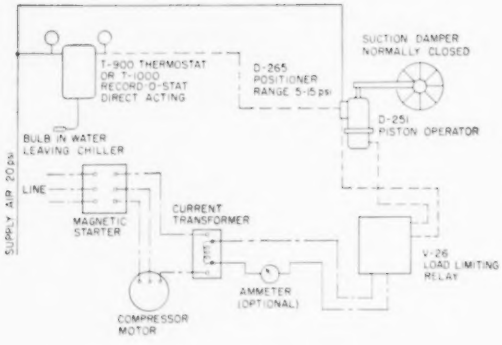
FOR POSITIVE PROTECTION AGAINST MOTOR OVERLOADING



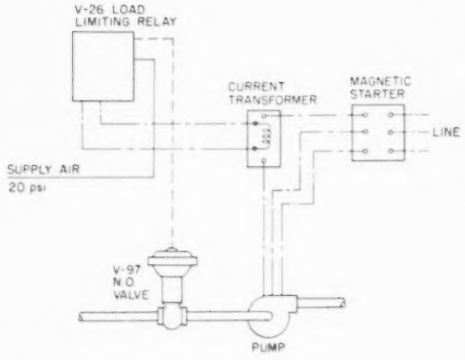
V-26 LOAD LIMITING RELAY

- A superior new limiting device for use with pneumatic control systems. Designed for application to all makes of centrifugal refrigeration compressors and to pumps, fans, and electric heating systems.
- Provides positive, efficient protection against motor overloading. Prevents failures and damage to valuable equipment.
- Operates at any current value between 3 and 7 amperes. With proper transformer, can be applied to motors of any size. Single adjustment determines maximum current input.
- Fast, highly accurate response. Pneumatic feedback element assures maximum stability and performance.
- Simple, trouble-free. No maintenance problems.

For full information, write for Bulletin V-26. Johnson Service Company, Milwaukee 1, Wis.



Load Limiting Relay used with piston operator for overload protection of centrifugal refrigeration compressor.



Load Limiting Relay applied to pump installation.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885